THE CLIMATE OF ENGLAND

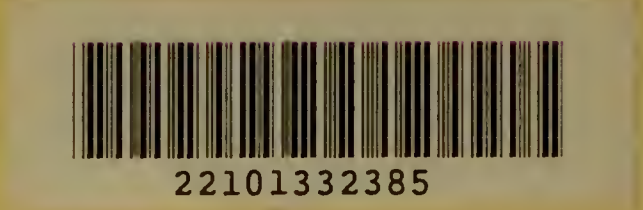


CHART OF THE CONSTELLATIONS,

Showing the Period of Jupiter round the Sun and the Principal Stars in each Constellation.

EXPLANATIONS

of

Astronomical Symbols of the Planets & Abbreviations.

- ☉ *The Sun*
- ☿ *Mercury*
- ♀ *Venus*
- ⊕ or ♁ *The Earth*
- ♂ *Mars*
- ♃ *Jupiter*
- ♄ *Saturn*
- ♅ *Uranus*
- ♆ *Neptune*
- ☌ *Conjunction*
- ☍ *Opposition*
- ---- *Orbit of Jupiter*

Explanations and Symbols of the Constellations.

♌	*Leo*	°
♍	*Virgo*	30
♎	*Libra*	60
♏	*Scorpio*	90
♐	*Sagittarius*	120
♑	*Capricornus*	150
♒	*Aquarius*	180
♓	*Pisces*	210
♈	*Aries*	240
♉	*Taurus*	270
♊	*Gemini*	300
♋	*Cancer*	330

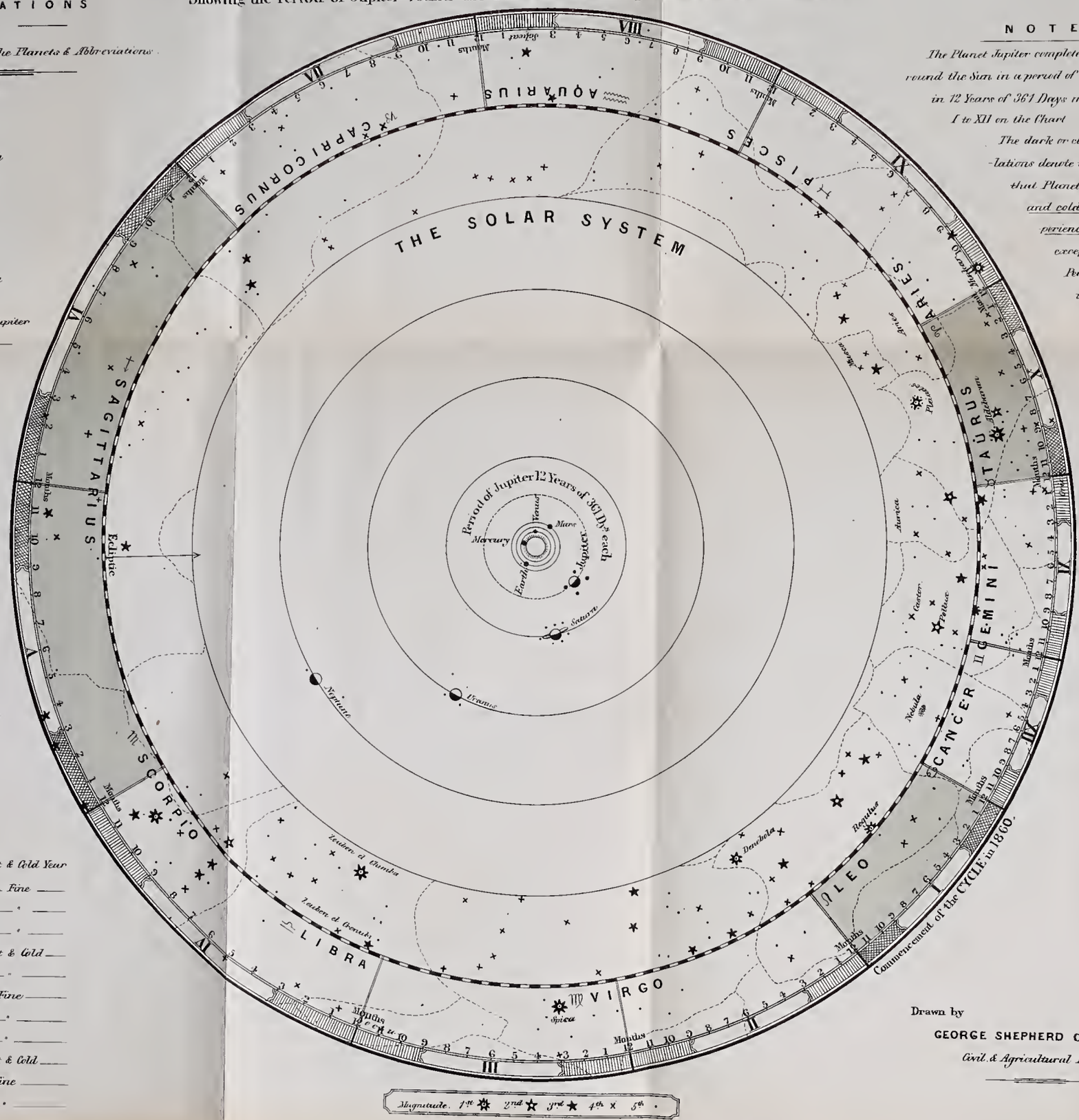
Meteorological Phenomena during the Period of Jupiter.

Jupiter in I	♌	*Leo*	*A Wet & Cold Year*
..... II	♍	*Virgo*	*Fine*
..... III	♎	*Libra*	°
..... IV	♏	*Scorpio*	°
..... V	♐	*Sagittarius*	*Wet & Cold*
..... VI	♑	*Capricornus*	°
..... VII	♒	*Aquarius*	*Fine*
..... VIII	♓	*Pisces*	°
..... IX	♈	*Aries*	°
..... X	♉	*Taurus*	*Wet & Cold*
..... XI	♊	*Gemini*	*Fine*
..... XII	♋	*Cancer*	°

NOTE.

The Planet Jupiter completes its revolution round the Sun in a period of 4332 Days, or in 12 Years of 361 Days numbered from I to XII on the Chart

The dark or clouded constellations denote the position of that Planet during the wet and cold years we experience in our Climate except when COMETIC *Perturbations occur in the* CYCLE.



Drawn by

GEORGE SHEPHERD C. E.,

Civil & Agricultural Engineer.

Printed by Spottiswoode & Co. London

THE

CLIMATE OF ENGLAND

ITS METEOROLOGICAL
CHARACTER EXPLAINED, AND THE CHANGES OF FUTURE
YEARS REVEALED

A SOLUTION OF THE GREAT PROBLEM
WHICH HAS DEFIED THE PHILOSOPHY OF ALL AGES

WITH METEOROLOGICAL TABLES FROM THE YEAR 1656 TO 1861

ILLUSTRATED BY A CHART OF THE CONSTELLATIONS AND SOLAR SYSTEM

WITH APPENDIX
ENGLAND'S POSITION AND ENGLAND'S ONLY HOPE

BY GEORGE SHEPHERD, C.E.

CIVIL AND AGRICULTURAL ENGINEER
AUTHOR OF "THE SEWAGE OF LONDON AND ITS APPLICATION TO AGRICULTURE"

"Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion?"—*Job* xxxviii. 32

LONDON
LONGMAN, GREEN, LONGMAN, AND ROBERTS
1861

DEDICATION.

TO

J. R. HIND, Esq., F.R.A.S.

LATE FOREIGN SECRETARY TO THE ROYAL ASTRONOMICAL SOCIETY;
CORRESPONDING MEMBER OF THE NATIONAL INSTITUTE OF FRANCE, ETC. ETC.

My dear Sir,

After a long and laborious research, I trust I have at length succeeded in throwing a considerable light on that hitherto obscure subject, the meteorological character, not only of the climate of England, but also of the whole earth. You were the first scientific gentleman to whom I had the honour of submitting the discovery recorded in this work, and from that moment you most kindly rendered me every possible aid, which materially lightened my task.

I have also had the benefit of your labours in another way. Many of the perturbations in our climate I could in no way account for until I had recourse to your excellent Work, "The Comets: a Descriptive Treatise upon those Bodies," &c. &c.

In addition to your works on the Comets, your brilliant discoveries have greatly increased our knowledge of the Planetary System.

As a small token of esteem for your scientific attainments and your patient astronomical investigations, I humbly dedicate this Work to you, sincerely hoping that you may be spared to continue those labours for many years to come.

In conclusion, I think the time has now arrived when we ought to substitute the word "astronomy" for that of "meteorology." It is quite clear that all the changes to which the earth's climates are subject are due entirely to astronomical phenomena. I hope all astronomers will be of the same opinion.

I am, my dear Sir,

Yours very truly,

GEO. SHEPHERD, C.E.

26 Throgmorton Street,
London, E.C.

ERRATUM.

Page 25, lines 21 and 22, *for* barometric, magnetic, or thermometric observations, *read* barometric, thermometric, or magnetic variations.

PREFACE.

In laying this Meteorological Discovery before my country I must first express my sincere thanks to our eminent astronomer J. R. Hind, Esq., F.A.S., for the great assistance he has rendered me in the astronomical part of this work, as well as for the great kindness and courtesy I have received from his hands on every occasion I have asked his aid and guidance.

In the Meteorological Tables I have recorded the character of our climate for a period of upwards of 200 years of its METEOROLOGICAL HISTORY: throughout this space of years our climate has been subject to the same cycle of meteorological phenomena.

I have endeavoured, as far as possible, to divest the work of technical phraseology, in order to render it the more comprehensible by the general reader.

The year 1860 brought with it terrible calamities on England. But if we receive great blessings and years of plenty at the hands of our Divine Maker, must we not also expect some years of apparent adversity? Yet if we regard *the great and beneficent laws of nature in their true light*, we shall rather be led to welcome these *meteorological events* as the greatest possible blessings, both as regards our health, comfort, and general prosperity.

When these plagues of rain and waters have burst upon us, it has

hitherto been the custom of our nation to fall on its knees before our Maker to ask Him to suspend his great and beneficent laws, *or, as it were, we implore him to destroy us entirely.* TRULY WHEN WE PRAY WE KNOW NOT WHAT WE ASK. But let us now be thankful that it has pleased Him to open our blind eyes and unfold to us this GREAT METEOROLOGICAL MYSTERY. The year 1861 we now know will bring us everything in great abundance with genial seasons for gathering the produce from the fields. For these blessings let us be abundantly thankful.

The great laws of Providence have again renovated our land, sea, and atmosphere, and nature again stands forth like a giant refreshed with new wine, to resume her labours, to bring increased happiness to the human race. Let us too be wise and do our duty. *Nature fails to produce vegetation from a barren rock, or food from a sterile or exhausted soil.* She, in her process of vegetation, like man, manufactures from the "raw materials:" if these are withheld, like man she is compelled to shut up shop and emigrate to more fertile soils; she is disgusted with the sloven who squanders her riches; she gives his wealth to others and leaves him rags and poverty.

To our National waste I have devoted the APPENDIX OF THIS WORK, and endeavoured to call the attention of all classes, who claim to have an interest in their country's welfare, to a sense of duty, in order to PROTECT THE HOMES, HAPPINESS, WEALTH, AND LIBERTY OF THE LAND OF THEIR BIRTH. I allude to that great National duty of our returning to the soil the treasures we receive from it. For be assured, once for all, if we neglect this,

> "The stately column will be broke;
> The beacon light quenched in smoke;
> The trumpet's silver sound be still,
> And the warder silent on the hill."

I have now solved the great meteorological problem of our climate, as far as my humble powers of investigating the law of nature will permit me. And I now ask my country to rally round and help me to solve a

second, but far easier problem, namely, that of restoring the fertility of England's soil. This is a subject to which I have devoted the study of years: when once the sewage of our towns is properly applied to our exhausted soil, we can at present form no estimate of the immense benefit it will confer on our nation, and on each one of us individually. Only let us remove our prejudices, doubts, and fears, and get to work in earnest: our renovated soil will then fill our barns with plenty, and our homes with bread; and peace will be within England's walls, and plenty within her palaces, and the beacon's light of the world, Liberty, will shine with additional splendour. Then the rains may descend, the floods come, and the storms of nature or war rage, her happiness, wealth, and prosperity will be built on that immutable rock which Nature herself never shakes.

But so long as we continue to deprive our soil of its richest treasures, so long are we building on a treacherous sand, a foundation which in the hour of need will give way, and the hollow fabric will fall, and who can predict how great that fall will be? WHO THEN IS ON ENGLAND'S SIDE? WHO?

LONDON: *May* 30, 1861.

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ADVERTISEMENT.

THE QUARTERLY METEOROLOGICAL ALMANAC
OF
GREAT BRITAIN.

The First Number will be ready for the press in a few days. Price 6d. per Quarter; or 2s. per Annum, free of postage.

In consequence of the great light the discovery recorded in the present volume throws on the "METEOROLOGY OF THE CLIMATE OF ENGLAND," and with the view of rendering this discovery available for the AGRICULTURAL, MERCANTILE, AND ALL CLASSES OF THE COMMUNITY, at the request of numerous persons, the Author has consented to publish an Almanac under the above title, which will contain the general character of each month throughout the year, and also the *meteorological character of the next succeeding year, thereby giving timely warning of the approach of the wet and calamitous years our climate is subject to, and described in this work.* The necessity for such a publication is at once obvious.

The METEOROLOGICAL ALMANAC will be entirely devoted to Meteorological, the Cometary System, and Astronomical Subjects, with occasional observations on Sanitary questions, and other useful information.

The Author will esteem it a great favour if persons residing in the country would forward him accurate accounts of any Meteorological Phenomena which may occur in their respective localities, namely, *thunder storms, heavy gales, whether by land or sea, extraordinary meteors, Aurora Borealis, or Northern Lights,* together with the state of the barometer, thermometer, and the direction of the wind, if possible, at the time.

All communications to be addressed to Mr. G. SHEPHERD, C.E., temporary offices, 79 Cannon Street West, London, E.C.

Persons intending to become Subscribers to the QUARTERLY METEOROLOGICAL ALMANAC *are most respectfully requested to forward their names and addresses. Post-Office Orders made payable as above.*

THE

CLIMATE OF ENGLAND:

ITS

METEOROLOGICAL CHARACTER EXPLAINED.

PART I.

"Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion?"—*Job* xxxviii. 32

The Meteorological Events of 1860.

The memorable year of 1860, the excessively cold late spring, the cold sunless summer, the wet and gloomy and disastrous autumn, with deficient harvest, high price of food, the drain of trading capital of England to purchase foreign food for our teeming population at home, and the certainty that this drain must continue until our harvest of 1861 is fit for the market: this, followed by a most severe winter, depriving our workmen of their labour, then the late gales strewing our shore with wrecks, and the loss of hundreds of our brave seamen in the raging waters, will remain a notable page in the history of England's disasters. During the years 1857, 1858, and 1859, we were enjoying boundless prosperity. Our barns were filled with plenty, and there was no complaining in our streets, with the exception of some foreign political complications; our ships brought their rich cargoes and glad tidings from afar, and all nature and nations revelled in luxury and happiness. But wait awhile, wait awhile, and the leaves of autumn fall on this prosperity; nature wraps herself in sleep, the storms of winter roar through the branches of the trees in the forests. We look on the desolate and barren scene, but in the midst of it the heart gladdens as we contemplate the approaching warm genial spring, when vegetation will first put forth her tender buds, then the blossom; when so many of the feathered tribes fill the air with their musical notes, and all nature revels in beauty; then of the sunshine of summer, the golden harvest, the laden boughs of autumn, and of all the pleasant reminiscences these

beautiful events bring in their train. But, alas! in 1860 these things come not: instead of the bright, warm, genial spring we so fondly expected, we found severe biting frosts and cold bleak winds; instead of the warm and brilliant sunshine of summer, the sun hides her head, the black heavens pour down torrents of rain, desolating floods sweep over the landscape where we fondly hoped to see the haymaker at work and sheep and oxen browsing in the bright sunshine.

As time speeds on its rapid flight the disasters increase. For instead of the golden harvest waiting for the sickle, and the brilliant rays of the autumn sun adding its lustre to the heaven-like panorama, the sky continues overcast as with a garment of lead, deluging rains still descend, and the raging torrents still flow in every direction. A general murmur runs through the land, and men's hearts fail them for fear the produce of the fields will be spoiled: part of it is already irretrievably lost. The first instinct of a Christian nation is a general invitation for a day of humiliation and prayer, for the nation to fall on its knees before the Almighty to ask for mercy and assistance at His hands in this great time of need. For a short space of time the leaden curtain is withdrawn, the sun peeps out, but his rays, instead of glowing with heat, are cold and feeble. But during this short and precious interval of dry weather, a portion of the grain is rapidly collected from the field, some little in good order, as it is termed: while a great portion of the harvest remains in the fields, to our dismay the sun again hides his head, the heavens assume their leaden hue, and the deluging rains descend day and night, except at short intervals. The worst fears are realised; the bulk of the harvest is damaged, and consequently deficient both in quantity and quality; then ensue high price of food, drain of the trading capital of England to purchase foreign food, and general stagnation in our trade.

While in this state of perplexity a most severe winter, intense frosts and cold overtake us: sad pictures present themselves to our view; our labourers are deprived of their usual occupations, and the families dependant on their labour are deprived of bread; thousands of our excellent workmen are reduced to extreme want together with their families, and are almost starving in the streets, while thousands more are shivering in their comfortless dwellings without food or raiment, depending on public charity for a mere temporary existence. Thousands with weak and delicate constitutions, which rendered them unable to contend with the intense cold, sank into premature graves, victims to lingering disease: but as we fondly hope to find eternal happiness.

"In pain they travelled here below,
Their couch was wet with tears."

But the sad picture is not yet complete, the cup of bitterness is not yet empty, and we must drink up even the very dregs. Calamities still come: desolating hurricanes sweep over the land and seas; our shores are strewed with the *débris* of wrecked ships, while hundreds of our brave seamen sink to rise no more, and in some instances their frail ships are dashed to atoms: when our poor seamen had returned from a long voyage, and are within sight of their own cottage doors, fondly contemplating a friendly welcome home from those they held near and dear, they are engulphed in the surging waves,—*lost* for ever to their homes, their friends, and their nation. In some instances tombstones will be erected in the neighbouring churchyards recording the terrible event, but their bodies rest not there, they are buried in the fathomless deeps.

Nor are the casualties on land less disastrous. We take up *The Times* from our breakfast-table, and with quivering lips we read of seventy, eighty, or one hundred and fifty, or even more, of our poor colliers being in one instant launched into eternity by explosions in our coal mines. In the details of the explosion we read of its terrific force, the earth shaking for miles round, of the flames rushing out at the pit's mouth, while the distressed and bereaved families fill the air with their agonising cries. They know that "hell-like furnace" is devouring their only hopes, and their only comfort on earth.* Need we here allude to the commercial disasters; the hard earnings of years all vanish in profitless speculations; homes are broken up by rude and unpitying hands; and the families, some aged and infirm, others with delicate forms, children unaccustomed or too young to commence the battle of life, are turned on a selfish world which has little or no sympathy for misfortune, but only bows its head and extols to the heavens wealth and success.

* All this, one blushes to state, "*is entirely preventable.*" It only requires a little legislative honesty, viz., let it be enacted that in all cases of explosion in a coal mine, that the proprietors of such collieries should be bound to provide for the future maintenance of the widows and orphans of those who perish: this done, we shall hear no more of explosions, and this terrific loss of life. It is a fact, that in nine cases out of ten the barometer gives ample warning for several days before these explosions occur; still this valuable instrument is not consulted. Again, the brattise system ought to be abolished, and an independent air-shaft sunk instead. This being done, a good current of air would sweep through the works and keep the whole system well ventilated. All the collieries in Shropshire are worked on what is known as the "long wall system," which admits of the most perfect ventilation, and the colliers work in security and comfort: should an explosion occur, it is from sheer carelessness, and of a most limited extent, and the loss of life most trifling. I record this as fact from long experience in coal mines, and also from having been for some time the general manager of a large colliery.—See Government Reports on Colliery Explosions, on Shropshire Colliery Ventilation.

Truly we can say on viewing the calamities of 1860, with David of old,

"Thy wrath is hard on us,
Thou hast afflicted us with all thy waves."

The Effects of Extraordinary Meteorological Changes on Our Climate.

The Divine Creator of the universe never intended to bring such heavy calamities on his children, without giving them the means of anticipating them, and by their natural instinct to make suitable provision in order to soften their rigours, break their terrible force, and thereby soothe many sorrows. I like that beautiful expression, that all things are written for our learning, whether in the pages of history, of nations, or in the great events of nature's laws; and these great meteorological changes to which our climate is subject, only require our careful investigation; then we shall find out of apparent chaos the greatest order, beauty, and sublimity. Great events in nature lead to careful investigation, and the result invariably is, great discoveries come to light, pregnant with the greatest blessings to mankind. With a continued prosperity men's minds are apt to become dull and blunted; the selfish become more selfish, the ignorant more ignorant, the scientific man lazy and careless, the working man more extravagant; then vice after vice creeps in, which leads to the direst calamities.

With a world so constituted, where each one is trying to make the most of to-day without regard to the future, we must regard these meteorological changes in the rotation in our years, not as mere calamities, but as the greatest possible blessing, not only to the human race, but to all created things. It is during the wet years, like 1860, that the soil comparatively rests from its incessant labour: in obedience to the great law of nature it yields deficient crops, and in some instances even those crops are recommitted to the soil as too damaged to be of use for food; during these incessant rains the earth, as it were, takes a bath and washes its face; its springs are replenished; the rains wash and purify the atmosphere, cleanse our polluted rivers, wash and purify our towns, invigorate our stagnant ponds, disperse decayed matter, and prepare old death for invigorating new life. These operations being complete, the severe frosts and snow of winter mollify the sodden soil, destroy weak and unproductive vegetation, and the over-abundant insect life gendered by warm and genial seasons. The great storms, the rough towels of nature, sweeping our land and seas, complete the process, carrying off the excessive humidity from the earth's surface and lightening the soil, and hence the old saying, *March dust is*

worth a guinea per peck, while at sea the storms disperse the decayed animal and vegetable matters carried into it by the land floods. In tropical climates, where the growth and decay is more rapid than in our climate, the great heat is followed annually by heavy rains, which occur with great regularity. We have to put up with some little inconvenience while our dwellings are washed, painted, new papered, and made clean for our comfort. So is it with the great laws of nature in her operations: the process being complete, the earth is comparatively renewed, purified, and replenished. What follows this renovating process is beautifully described in the 65th Psalm, in the sublime words:—

"Thou visitest the earth, and waterest it: thou greatly enrichest it with the river of God, *which* is full of water: thou preparest them corn, when thou hast so provided for it. Thou waterest the ridges thereof abundantly: thou settlest the furrows thereof: thou makest it soft with showers: thou blessest the springing thereof. Thou crownest the year with thy goodness; and thy paths drop fatness. They drop *upon* the pastures of the wilderness: and the little hills rejoice on every side. The pastures are clothed with flocks; the valleys also are covered over with corn; they shout for joy, they also sing."

So will it be with the year 1861: without a doubt we shall enjoy a fine spring, a beautiful summer, a golden harvest, with laden boughs. But without the cold springs, the occasional wet summers and unfruitful autumns, this earth's baptism of waters, what would have been our lot? If left to the control of selfish man, he would have exhausted the soil, and exterminated his own race long ago, and rendered the earth's fair surface a wilderness of thorns and briars. The divine command to the Israelites was that the land should rest every seventh year; but in modern days the soil knows but little rest: but a *rest* nature herself has wisely provided, and the time of that *rest certain*.

If we refer to the meteorological Table I. of our climate, from 1800 to 1860, and examine the years from 1854 to 1858, we have four years of great abundance and most beautiful seasons. In the year 1857 (Series X.), instead of being wet, we had fine seasons, with abundant crops; but when we come to 1859, although a splendid year as far as the seasons were concerned, we only had "*medium crops*," and generally an inferior quality of grain, and had not the wet year of 1860 intervened, but fine weather continued, without doubt each year the crops would have been more and more deficient, with increased inferiority in quality. The land will not bear this incessant drain, and if England forgets this and throws the riches she obtains from the soil into the nearest streams to her towns and dwellings, she must be prepared for greater calamities than we have experienced during the year of 1860

and the spring of 1861. We must not expect the unerring laws of nature to suspend their operations to favour man's ignorance, to yield to his superstitious or selfish prejudices.

Our Prejudices.

All history from the foundation of the world shows that, so long as man continues to be guided by his prejudices, so long does he remain in a state of degradation. Every prejudice is a dire calamity in itself, for, at some time or other those who entertain it are surely and severely punished for their blindness and folly. How many times have we witnessed it during the present century, nay, almost every day of our lives, and it stands continually in the very gate of man's happiness, and prevents the progress of men and nations.

Ignorance and prejudice placed Galileo in a prison cell. It made even "Newton's life bitter." It cursed Watt to his face. It caused Stephenson to exclaim with bitter anguish of soul against the ignorance of his day. It put down the discovery for lighting our towns with gas as the suggestion of a madman. It pooh-poohed the discoveries of Wheatstone; and a celebrated knot of twelve Admirals came to the conclusion that it would be impossible to apply steam to the navy of England.

The great discoveries of these great heaven-sent men pull down the high hobbies, upset fanciful theories, and in their stead establish great truths, and bring into active operation the highest intellects of the human race.

The earth still continues to revolve in her orbit round the sun, and the great laws expounded by Newton still continue in force. The great power steam from the earliest ages of the world was seen issuing from every vessel when filled with water and placed in contact with the no less powerful agent fire. Attempts were made to confine it in iron-ribbed vessels, but it burst its bands asunder and proclaimed itself a great power, only waiting a friendly hand to introduce it as the greatest benefactor to the human race, whose daily companion it was. James Watt after great labours succeeded, and this docile power now puts thousands of spindles in operation, weaving the various fabrics for our health and comfort. It moves our most ponderous machinery; raises our minerals out of the depths of the earth; its use is also extended to a thousand other operations in the manufactures connected with our commercial life. Bidding defiance to the winds and waves, with the aid of steam our ships plough through the ocean, and convey intelligence and commerce to almost every habitable part of the globe, and with almost

unerring punctuality, making all the nations as one family in interests and sympathy. Stephenson, again, in his day extended the operations of this great power. It now wafts us along our iron roads with terrific flight; it has made our great nation almost as one family.

Nasmyth rendered steam so docile that in his hands it will either form the most massive pieces of iron into the shape required, or the same ponderous hammer will crack a small nut without crushing the tender kernel inside the shell.

Until within a few years that great and subtile agent electricity was flitting round us in every action of our life, performing its great functions unseen in all the great operations of nature: in decomposition, as in recombination, it is the most active agent in the universe. Yet years rolled on with it knocking at our doors, like its great and powerful sister, steam, waiting only to be admitted to our society as the friend, the faithful servant and benefactor of man, who for ages only regarded it as a terrible enemy, which sometimes struck his house or occasionally killed a few of his sheep, or perhaps one of his family fell during one of the lightning flashes. In a word, he regarded this great and useful agent only as a scourge sent to afflict and punish. And long after the celebrated discovery of Œrsted of Copenhagen the power of electricity remained a mystery for years. Now it plays an important part in our daily life; it mixes in our society as a familiar friend; in the Electric Telegraph Company's Offices it is obedient to the guidance of a bevy of young ladies, who transmit communications between man and man, and nation and nation, fleeting along its wiry nerves over hill and vale, piercing the deep sea with the rapidity of thought itself, carrying news of joy to some, of misery and disasters to others. It brings us invitations to a banquet, and it conveys to us the message of death. It annihilates time itself: none can measure its speed. The man who attempts to use it for his vile and selfish purpose only degrades himself.

Need I refer to the great discovery of gas, which illuminates our streets and dwellings? This great agent was first confined to small experiments, yet on all occasions it vindicated its usefulness, and proclaimed itself a great power, knocking at our doors and anxiously waiting to be the servant, friend, and protector of man, and like its fair sisters, steam and electricity, ready to raise him from his ignorance and superstition, to shake off his doubts and fears, to instruct him in the great laws which govern his very existence, and to make him a more fit companion for his Maker, both here and hereafter.

In the bright pages of the history of astronomy,— that sublime science which has chained to her chariot wheels the highest intellects of the human race from

the earliest ages,—we read with rapture the brilliant discoveries of Galileo, Kepler, Newton, Bradley, Leverrier, Adams, Hind, Ross, Airy, and other kindred and choice spirits. In the labours of these great men we see how one great law after another has been discovered; light after light has continued to pour its rays and add to our knowledge on this most sublime and interesting science; it guides our ships through the trackless deeps to foreign climes, and reveals to us the eclipses and other celestial phenomena. Now it further exalts itself and claims a place in our daily life. It unfolds to us the laws which govern the most extraordinary changes in the rotations of years to which our climate is subject, and enables us to anticipate with remarkable precision the approach of those wet and disastrous seasons, like 1860, which in our hitherto unprepared state brought the great calamities on our nation I have feebly attempted to describe in the first pages of this work. It also foretells us the approach of warm genial seasons, with abundant harvests, so that we may fill our barns with plenty against the day of adversity, and thereby break the force of these terrible calamities, and mitigate great sufferings.

Singular Meteorological Theories.

Great discoveries require but a brief description, but before going into details it may be as well to examine the various theories advanced from time to time as to the cause of the extraordinary changes in our seasons. The cause of these meteorological changes has been variously discussed, and numerous theories have from time to time been advanced to explain the phenomena. The spots on the surface of the sun have for years been carefully scrutinised, and to these spots have been attributed the changes of our seasons. Some go so far as to say that, when the sun's surface contains a great number of spots, its heat is diminished, and hence the changes referred to; while others are of quite the reverse opinion, namely, that when the sun's surface contains a great number of spots, we have the hottest seasons; as, for instance, in 1858-9. One gentleman who paid great attention to this subject, predicted that the excessive heat in 1859 would continue for several weeks, but unfortunately for him the weather broke up two or three days afterwards, although the spots remained on the sun's surface in the same relative position to each other, which clearly proved the fallacy of the theory of the sun's spots.

During the cold years of 1852 and '53, I heard a most remarkable theory advanced by a most remarkable personage in an omnibus one morning. This theory was that our earth at last had begun to recede from the sun; the earth's orbit had

assumed a spiral form; and although the earth completed its revolutions round the sun exactly in the same space of time every year, still it was gradually receding from it and sinking into space, precisely as a female screw sinks on the spiral thread of the male screw; this being the case every year, the temperature of our planet would diminish, and at last become a solid block of ice, and the inhabitants perish. I hope I have properly understood my travelling friend's theory, and recorded it accurately.

Another equally remarkable theory was advanced about the same time, namely, that the whole visible universe, *i.e.*, the whole heavens, including our planetary system, was revolving round some unknown centre, and we had at last got into the northern latitude of that great circle, round which the universe was revolving, and that the cold season may last for many years.

Another theory is advanced by M. Remon in his paper read before the Academy of Sciences at Paris. M. Remon states these extraordinary changes are the result of *profound oscillations:* whatever he may mean it is impossible to say; he fails to tell us where, how, or when these oscillations occur, whether in our planet or not.

The change in the moon, both in country and town, is a great event, and especially so among our farming community, who continually build their hopes on these changes; and if on one occasion out of twenty the weather should happen to alter a few days after the change, they feel convinced of the fact that the moon possesses the power of controlling the entire meteorology of our earth, and the almanack maker does not fail to remind them in his next impression of the great fact that his predictions happened to be right for perhaps once in several years. All these theories are mere fancies.

It is our unfortunate lot when great events occur for some person equally ignorant with his fellow man to rise up with some imaginary theory, and if he should happen to be a man of *position*, his theory has all the more weight; by doing so such people stop the progress of inquiry, and place science in as equally a false position as himself. No objection can be raised against a man making every possible inquiry; but at the same time it would be advantageous to the progress of science if we were to give the result of our investigations faithfully, as far as we have gone, without jumping at the conclusions M. Remon has done. We should be rendering the greatest services and promoting inquiry. I merely record these theories to show what whims men received as sublime scientific facts in the 19th century.

Position of the Sun, the Earth, and her Satellite.

We next proceed to consider the relative position of the sun, the earth, and her attendant, the moon: that great luminary is fixed in the centre of our system, and round which revolve the great family of planets in their respective orbits, each one completing its revolution with unerring accuracy, no matter how near or how distant the planet may be from the great luminary itself.

Between us and the sun are the orbits of Mercury and Venus; next is our earth, with her orbit fixed at about 95,000,000 of miles, and completing her revolution round the sun in 365 days, 5 hours, 49 minutes, 57 seconds; the moon in her orbit completes her revolution round the earth in 27 days 8 hours. The 365 days we divide into seasons of three months each, spring, summer, autumn, and winter: now during the rotation of these seasons we have the same length of days and nights in each respective season; the earth goes through the same phases; the moon performs her revolutions with the same marvellous accuracy; both these bodies remaining at the same respective distance from the great luminary round which they unceasingly revolve. This being the case it would naturally suggest itself to our minds that each of our seasons with all this regularity would be near alike as possible, and that each succeeding year would be like its predecessor, without variation in temperature or meteorological change. But this is not so: if we refer to the Meteorological Table I., we shall find we never have two springs, summers, autumns, or winters alike in regular succession. One year we have a mild early spring, fine summer, an abundant harvest, with a cold frost and snow during winter, as in 1851; the next year we have a dry parching spring, wet summer, deficient crops, wet and changeable winter, as in 1852; the next year, 1853, we have a cold spring with severe frost and snow, and after this excessive wet with desolating floods, a wet and changeable autumn, with only a very winterly December: take the two wet years or any series of the years in succession, and they differ from each other in almost every respect. Take again 1859 and 1860: the former was preceded by a mild winter, very early spring, very hot summer, fine autumn; take the latter, it is preceded by a very cold winter, wet, cold, and bleak spring, a gloomy, cold summer, a wet autumn, and excessively wet winter; nay, even the temperature and general aspect of nature itself was entirely changed from that of the preceding year. For instance, in 1859 the heat during the summer and autumn months was so excessive that both men and cattle died from what is termed sun-strokes; while in the succeeding year, 1860, we have the reverse of all this, a very low temperature throughout the year; even when we were fortunate

enough to obtain a glimpse of the sun its disk presented a pale cold appearance; throughout the whole year in fact the appearance of the sun during the winter months; the clouds also presented a most singular aspect, in appearance like that of a troubled and tempestuous sea, with long thin ribbons of spray-like streaks of clouds stretched for many degrees in length across the heavens.

From these phenomena the only conclusion we can come to is that the same law which controls the meteorology of our earth controls the action of the sun itself on our planet.

The Sun derives her Source of Light from the Planetary Bodies.

A few words now on the great luminary, the sun, itself. Various theories have from time to time been advanced as to the source from which the sun derives that perpetual supply of fuel to maintain her ever vigorous celestial fire. I have also devoted years to this very interesting and important subject, and I beg to record it as my firm belief that the sun receives her perpetual supply of light from the planetary bodies which revolve round her in their respective orbits: this may appear a bold assertion, still the more we examine this hypothesis the more we shall feel convinced that such is the great fact.

All persons versed in electrical science will admit,—and we must draw our deductions and conclusions from the materials at our command,—that whenever the process of decomposition and recombination is in operation,—that law which put all things created in active employment,—electricity is the most active in these operations. If we raise our eyes from the small galvanic battery, we shall find this process going on both on the surface and in the bowels of the earth, in every stage of universal life, whether in the animal, vegetable, or mineral kingdoms.

In animal and domestic life every drop of water we evaporate, in every morsel of food consumed, and in all the stages and changes of animal life, the great process of decomposition and recombination is everywhere in active operation; every particle of matter our bodies contain when we go to the tomb returns to its original element. Electricity is present, and the most active, if not the sole, agent in this great operation.

> "When a monarch or a mushroom dies,
> Awhile extinct the organic matter lies;
> But a few short hours, a year's resolve,
> Electric powers the changing mass dissolve,
> And emerging matter from the grave returns,
> Feels new desires and new sensations burn."

But when we come to the vegetable world, this great process of decomposition and recombination is still more astounding; it is here in operation on a terrific scale: when the seed is cast into the ground the process of germination commences, the root expands, spreading its fibres in every direction. Each of these delicate fibres is in itself a perfect electrical battery, and like the entire root dissolving and sending up the choicest elements of the soil for the formation, nourishment, and growth of that beautiful recombination which forms the vegetable world, and consequently food for the animal kingdom; these choice elements ought again to be returned to the soil, instead of being thrown away as worthless, and polluting our fair streams. Of this we shall speak more fully elsewhere.

With these facts before us, let us for a moment consider the vast mass of decomposition or electric action going on in, say, for instance, a single field of wheat, and the recombination of the various chemical agents which form the crop of straw, grain, &c., and from this field let us raise our eyes to the habitable surface of the earth, and contemplate, if it were possible for the mind to grasp the subject, the vast amount of electricity in active operation, producing in each climate those most marvellous productions we find in the vegetable world.

From the vegetable let us take a glance at the mineral kingdom. We know, during the operation of the galvanic battery, pure metals rapidly combine, and become alloyed with sulphates, oxides, &c., &c., and the process of decomposition and recombination is there most complete. If we descend into our mines, we see similar phenomena; all our veins of minerals are in a state more or less combined in the same chemical and most beautiful order.

If we examine the earth itself, geology points out to us the old and new formations, and formations in a state of transition: here we observe old formations transformed into new foundations, and the whole earth renewing its constituent powers internally and externally; old things pass into new; the change, though imperceptible to human view, is nevertheless in perpetual operation, and whether in the earth, or on its surface, electricity is the chief agent.

We know, also, that the electric current passes through every part of the earth and over its surface, the magnetic needle being the visible portion of that active and subtle power.

This being the case, it is impossible that our Divine Creator, whose works are so complete, so full of wisdom, order, and beauty, ordained that this great, powerful, and swift-winged agent should be confined simply to these operations within the limits of our earth alone, and when everything else in nature performs so many operations, and so full of activity.

If we want to see a borrowed ray of the sun, look at that beautiful, brilliant, sun-ray, the electric light; a light produced entirely from the decomposition and recombination of metallic bodies, and one day destined to illuminate our dwellings, and turn our night into the brilliant sunshine of day.

If we wish to see the same borrowed ray temporarily detached from the great luminary itself, stand on some elevated spot at midnight, when the heavens are black with clouds during a thunder, or more properly speaking, during an electrical storm; examine the bright and sun-like brilliancy of each succeeding lightning flash, and by that momentary light examine the colours of the flowers at your feet, or you may hold in your hand. Any person who has paid the least attention to this great subject must and can come to but one conclusion, that the light produced from the galvanic battery and the lightning flash is neither more nor less than the detached ray of that light which proceeds from the great central luminary itself.

The next question would be, but how does this great agent travel to the sun, a distance of 95,000,000 of miles from the earth? I reply, by the same means as it rises into the upper regions of our atmosphere. Our Divine Creator requires no visible electric wires to carry on His great operations; our railway trains travel their fifty miles per hour. Our earth itself travels in her orbit 68,000 miles in the same space of time; but these bodies are slow coaches when compared with the speed of electricity, which flits through space at a rate utterly unknown to man; and all attempts with his imperfect machinery fail to measure its terrific speed.* After having performed its several functions on and in our earth, the same operations without doubt are going on in the other planets,—these electrical batteries of nature,—on the electric current flies to that great central focus, and there our earth adds her quota of illuminating power to sustain that ever brilliant heavenly flame, which in return diffuses its genial rays, giving life, light, and happiness to the universe. The north and south poles of the planets being the poles of these great batteries, no matter whether these planetary batteries are in close proximity to, or sweeping round that luminary in remote space, each one joins in this great operation. The electric current is in continual action between the great luminary and the planetary system: having completed its work there, back it flies, and resumes its activity in each planet, out of old death prepares new life, and thus the great system of universal life is sustained in harmony, beauty, and sublimity.

* If I mistake not, Professor Wheatstone made an attempt to measure the speed at which an electric current travels through copper-wire conductors, and gave it as his opinion it travelled at a rate of over 280,000 miles per second.

Nor is the electric influence confined to our planetary system, it extends to the universe. I can imagine the afflicted Job in the Land of Uz, with his Divine Master standing before him during that no doubt midnight scene, with his hand stretched towards the brilliant, starry firmament, uttering these memorable words, "Canst thou bind the sweet influences of Pleiades, or canst thou loose the bands of Orion?" It is clear from this passage, and from our astronomical observations, that the planetary system works in beautiful harmony with the most distant worlds in the universe. And though those worlds are at distances immeasurable to man, to that swift-winged messenger, electricity, they are but a short span. What a small portion man performs in these great operations, and that little is invariably done in direct opposition to nature's great laws.

"O how unlike the complex works of man,
Heaven's easy, artless, unencumbered plan."

COWPER.

We have carefully examined the sun with its brilliant active life; the theory of the spots on its surface; our earth, with its active animal, vegetable, and mineral life, the precision with which she completes her revolution in her orbit round the sun. We have also examined the theory of the change of the moon, which we are told possesses no external atmosphere, without vegetation, and altogether presents a scene of barrenness and desolation; in all these we fail to find anything on which we can lay the smallest atom for a foundation on which we can build even a theory to account for these extraordinary changes our climate is subject to during the rotation of years. It is recorded in Holy Writ that when our Divine Creator formed the earth He made two great lights, the greater light to rule the day and the lesser to rule the night; He made the stars also: from this we have conclusive data that our planetary system was launched from the Divine hand into their respective orbits at the same time as our planet; these functions both sun and moon faithfully perform, and, comparatively speaking, there those functions end; neither one nor the other of these bodies materially influence the meteorology of our planet.

METEOROLOGICAL ORDER OF THE CLIMATE OF ENGLAND FROM 1800 TO 1861.

The meteorological phenomena of our planet have puzzled the philosophy of all ages: some years we have mild winters and early springs, warm summers, fine autumns, with abundant crops; these are followed by a year of dire calamity: so confused and so chaotic did it appear that many who have paid the greatest attention to this subject for years declared it impossible to solve this great problem,

and even went so far as to state it was their firm belief these great meteorological changes were subject to no law it was possible for man to discover. But out of all this apparent chaos it will be observed, on referring to the Meteorological Table for upwards of 200 years, that, as far as the great law of nature is concerned, there is the most perfect order, beauty, and sublimity. The only link I fear wanting to complete this interesting discovery will be man's neglect in not recording faithfully each and every meteorological change in our climate, as the hundreds, nay thousands, of years have run off the reel of time into eternity.

In the annexed tables I have collated from the most correct data possible to obtain on this important and very interesting subject the various changes in our climate. Each column contains a period of twelve years, numbered from I. to XII. successively: the reason for this division of the years will be explained hereafter. Commencing with the Series I., Table I., its dates are 1800, 1812, 1824, 1836, 1848, 1860; in this series we have a terrible array of disastrous years, each like its companion, bringing with it ruin and misery: 1860, like 1800 and 1812, fills a most notable page in the history of England's disasters, a faint sketch of which we endeavoured to give in the first pages of this work.

In Series II. we have the dates 1801, 1813, 1825, 1837, and 1849; in this series we have cold but not late springs, fine warm summers, fine autumns, abundant harvests, with cold weather towards Christmas: such is the season the humble philosopher of this discovery predicts for the year 1861, which the spring season is nearly faithfully following in the track of its predecessors in the same series.

Next we come to Series III. and IV.: with one exception, 1839, we have fine seasons, and by carrying it into 1862, we can anticipate the seasons in store for us, and the same rule will apply to succeeding years.

In Series V. and VI. we come again upon a ghastly array of disastrous years; in these series stand by themselves the memorable years of 1805 and 1816, which brought with them so much sufferings and misery in England; in these there does not appear to be the regularity and order we have in either Series I. or in the Series X., commencing with 1809. For instance, in the column commencing with 1800 we have only one wet year, namely 1805; in the column 1812 we have the same phenomena.

In 1824 we find two wet and cold years, 1828 and 1829, in succession, but neither so disastrous as the one single year in the preceding columns. While in the next column we have also two wet years, 1839 and 1841, while the intermediate year 1840 we have a fine spring, very dry year, hot from April to August, a fine

harvest; then commences the severe winter and very indifferent year throughout, while in the column 1848 we have the two wet years together, namely, 1852 and 1853, in the same order as in the column headed 1824.

In the three next series, VII., VIII., and IX., and the corresponding years in the other columns, we have a succession of fine seasons; in fact, almost the same years reproduced, as will be observed on reference to the seasons in each year, which may be described as being preceded by severe winters, cold springs, fine summers and autumns with abundant crops.

We next come to Series X., commencing with the year 1809, the dates of which run, 1821, 1833, and 1845. But in 1857 we find a singular interruption in this cycle, to which I shall invite most special attention shortly. In this series stands the memorable year of 1845, which introduced the terrible potato disease, which brought such disasters on the poor classes in Ireland. Tracing this series back, in it we find the memorable year of 1665, Meteorological Table III., which introduced the "TERRIBLE PLAGUE OF LONDON," which carried off 68,000 souls. In this series also we have the singular phenomena that each of these years ended with very mild winters, which preceded the mild early springs in the next series.

We next come to Series XI. and XII., which, with the exception of 1823, run through the columns like a golden thread, preceded by a mild winter, then fine early springs, bountiful harvests, the boughs laden in autumn with fine fruits. These are wound up with a severe winter, and the circle again commences; thus out of a period of twelve years we have four wet years (except when the disturbing influences occur, as shown in the columns headed 1800, 1812, and 1848), which bring us deficient crops, and in almost all instances high price of food, a drain of gold for foreign food to supply the deficiency, commercial distress, with terrific gales and disastrous shipwrecks, and all the train of consequences.

If we refer to the Meteorological Tables II. and III., as far back as 1656, we shall find the same meteorological order as in that of the present century.

As I before stated we fail to trace anything to the action of the sun, the earth, or the moon, on which we can build the slightest foundation for a theory to account for the mysterious changes our climate is subject to, now disclosed to our astonished eyes. No, we must leave the sun, the earth, and her fair attendant, if we are to solve this great problem, and soar into that paradise of science where

> "All the stars around her burn,
> And all the *planets* in their turn,
> Proclaim their tidings as they roll,
> And spread His truth from pole to pole."

I now humbly, yet boldly proclaim, that the planet Jupiter, not excepting Saturn, Uranus, Neptune, or the smaller planets and those great wanderers the Comets, as they revolve in their respective orbits round the sun, control, both directly and indirectly, the meteorology of our climate. I think it is so conclusive that there remains not a shadow of doubt as to the great fact.

Those not well acquainted with the planetary movements, will find that these bodies complete their revolutions round the sun as in the annexed Table.

Order of the Solar System.

Names of the Principal Planets.	Comparative Magnitude of each Planet in Miles.	Mean Distances from the Sun in Millions of Miles.	Hourly Motion in Miles.	Period of Revolution in Days.
The Sun . . .	883,000			
Mercury . . .	3,140	37,000,000	110,000	88
Venus . . .	7,800	69,000,000	80,000	225
Earth . . .	7,912	95,000,000	68,000	365
Mars . . .	4,189	145,000,000	55,000	687
Jupiter . . .	89,000	496,000,000	30,000	4,332
Saturn . . .	76,000	909,000,000	22,000	10,759
Uranus . . .	35,000	1,828,000,000	16,000	30,687
Neptune . . .	75,000	2,862,000,000	12,000	60,126

It will be observed in the table, the planet Jupiter completes its revolution round the sun in a period of 4332 days, or 11 years, 317 days of our time. But if we divide the 4332 days, the period of her revolution, by 12, it gives us exactly 12 JOVIAN YEARS of 361 days each, which time corresponds with the 12 revolutions of our earth round the sun, or 12 of our years. In this order is arranged the Meteorological Tables, with the years numbered from I. to XII. successively. The astronomical order of the twelve constellations are : — Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces.

It will be observed in the chart of the constellations and solar system, the cycle is arranged in accordance with the Meteorological Tables, and the wet, cold years distinguished from the fine years; the former in red ink, the latter in black.

It will be also noticed when Jupiter is in Series V. and VI., unless a perturbation arises, we have two wet years in succession. While, when that planet is in opposition we have two fine years between two cold years. See Table Series XI. and XII.

During Jupiter's period of twelve years round the sun, we have the following

Meteorological Order.

Cycle.	Period of Jupiter 12 Years.	Constellations.	Meteorological Order of the Cycle.
Series I	Jupiter in	♌ *Leo*	*Late spring, wet cold summer and autumn, changeable winter.*
II	,,	♍ Virgo	Early spring, fine summer and autumn, mild winter
III	,,	♎ Libra	Cold spring, ,, ,, cold winter
IV	,,	♏ Scorpio	Cold spring, ,, ,, wet mild winter
V	,,	♐ *Sagittarius* and part of	*Early spring, wet warm summer, wet autumn, mild winter*
VI	,,	♑ *Capricornus*	*Cold spring, wet summer, wet autumn, severe winter, great storms*
VII	,,	♒ Aquarius	Cold spring, fine summer and autumn, severe winter
VIII	,,	♓ Pisces	Changeable spring ,, ,, changeable winter
IX	,,	♈ Aries	Cold spring ,, ,, ,, ,,
X	,,	♉ *Taurus*	*Wet spring, wet summer and autumn, mild winter*
XI	,,	♊ Gemini	Early spring, fine summer and autumn, mild winter
XII	,,	Cancer	Cold spring, ,, ,, cold winter

The fine weather we almost always enjoy when Jupiter is in the constellations ♊ and ♋. I am inclined to consider this phenomenon entirely due to the "*sweet influences of Pleiades, and the bands of Orion.*"

It is also very clear that the winters which precede and the springs which succeed the cold, wet years bring us violent storms, like the November hurricane in 1859, and the late gales this year.

We have now traced the cycle of the climate of England, and in this cycle we experience all the changes and perturbations our climate is subject to.

Cometic Influence on the Meteorology of our Climate from 1800 to 1861.

We now come to another important part of this inquiry, namely, the singular perturbations in each cycle as shown in the meteorological tables. These perturbations appear to be entirely due to "*cometic influences.*" Commencing with Table I. the present century, we have a cold wet year with *deficient crops.* From 1801 to 1804, we have good years, fine seasons with abundant crops. In each of these years a small comet is discovered in the heavens. (See Mr. Hind's History of Comets.) But instead of 1804 and 1805 being wet and cold years, as is the case in the succeeding cycles, only 1805 is a very wet, cold year with late

and deficient crops,—altogether a disastrous year; the years 1806, 1807, and 1808, we have three very fine years. But in 1807 a *fine comet* is visible in the heavens, and we enjoyed a bountiful harvest; 1808 also a fine bountiful year, but with heat so intense that men and cattle died in various parts of the kingdom; while the year 1809 is the reverse of all this, a cold, wet year with late deficient crops, and as disastrous as 1805.

It appears clear that the comet of 1807 caused the perturbation in 1804, changing that year from *wet* to *dry*, and also the "*intense heat in* 1808."

During the years 1810 and 1811, we have again very fine fruitful years, with bountiful harvests. In 1811, a splendid comet is visible in the heavens; a second fine comet is also visible the same year. Although both comets were large, yet, beyond producing bountiful years with fine seasons, there is no perturbation in the cycle, excepting in 1804 before described. In 1812, the cycle again commences with a most dreadful year; it is described as a dry, cold, late spring, a treacherous summer, with a wet autumn, very deficient crops, and cold winter.* Notwithstanding this disastrous change in the climate, a comet was visible that year in the heavens, which without doubt produced a corresponding drought in other latitudes.

The years 1813, 1814 and 1815, are fine fruitful years, more particularly 1815, which is amongst the finest and most fruitful years on record, with bountiful harvests. In this year the comet known as "Olbers' Comet" is visible in the heavens; this fine year is succeeded by 1816, a year as wet, cold and disastrous as those of 1812 or 1860. In this cometic perturbation, instead of two wet years as in the cycle commencing 1824, there is only one, into which all the elements of fury are crowded, precisely as in the year 1805.

From 1817 to 1820, we have again fine fruitful years. In 1818 there is a *severe drought with great heat all the summer;* in 1819 a comet is visible in the

* If we refer to the price of wheat during these wet years, some idea may be formed of the terrible calamities which fell on the English nation at the commencement of the present century:—

Average price of wheat in			1800	... ...	114*s.*	per quarter.
,,	,,	,,	1805	... ...	112*s.*	,,
,,	,,	,,	1809	... ...	90*s.*	,,
,,	,,	,,	1812	... ...	127*s.*	,,
,,	,,	,,	1816	... ...	98*s.*	,,
,,	,,	,,	1860	... ...	63*s.* to 70*s.*	,,

While each wet year shown in the meteorological table has caused a great drain of gold to purchase foreign food, and consequently a monetary crisis in England. If America and other wheat-producing nations had been in the same position as England in 1860, the consequences would have been too terrible to contemplate.

heavens, which perturbation seems to be the cause of the drought in the preceding year. The year 1821 again brings us into the wet period of the cycle, Series X.

The year 1822 is a remarkably fine year, with a bountiful harvest, whilst in 1823 we have a remarkably bad year, and to all appearance an inexplicable perturbation. But during this year a singular "*phenomenon*" *occurred in the heavens*, which Mr. Hind describes "as a fine comet discovered in various parts of Europe in December and observed till the end of March 1824: this comet is remarkable as having exhibited a *tail directed towards the sun, in addition to another in the usual position.*"

This phenomenon is most singular, both as regards the extraordinary comet itself and the perturbation in the meteorology of our climate.

The year 1824 *again commences the cycle*, and in character with others in the same series, from 1825 to 1827 we have again fine years with bountiful harvests. In 1825 four comets are discovered; the fourth and greatest is described by Mr. Hind as the Great Comet of 1825, or as it was at first called, the "Comet in Taurus." The heat this year is again so intense that men and cattle died from sun strokes in various parts of England; but altogether a most fruitful year, and the two following years of the same character. We now come to the *two wet, cold years* in succession, the first in this century in these series: their character is described in the Table, or may be summed up in one word, "*disastrous.*"

From 1830 to 1832 we have fine years*: in 1830 two comets are discovered, one visible to the naked eye; in 1832 three comets are discovered, and during these three years we have most bountiful harvests. 1833 again brings us into the Series X. with its cold spring and summer, wet autumn and "deficient crops." The years 1834 and 1835 are fine years with bountiful harvests. In 1834 one small comet is discovered: in the year 1835 no less than three comets are discovered, one of which is the "*celebrated comet of Halley,*" and in both these years we enjoy splendid seasons with bountiful harvests.

The year 1836 *again commences the cycle* with the usual wet, cold, and disastrous seasons; no record of any comet being discovered this year.

The years 1837 and 1838, the former with a cold, unhealthy spring, fine summer and autumn, and fine harvest; the latter, a cool summer and autumn with moderate crops: this year only one small (Encke's) comet is discovered. In 1839 and 1840 we have a singular perturbation. On referring to the years 1828 and 1829

* In 1831 we have no record of any comet being discovered: this year introduced the *cholera*.

we find the two wet years succeed each other, but in this instance 1839 is a wet cold year, no record of any comet being discovered, while 1840 is a splendid and fruitful year, "*with four comets in the heavens.*" 1841 is a wet and cold year: "*again no record of a comet being discovered,*" or one fine year in the middle of two wet and cold years*,—a most conclusive proof of the influence of the comets on the meteorological order of our climate. From 1842 to 1844 we have again fine years. In 1842 "two comets" are discovered; we have a fine fruitful year. In 1843 three comets are discovered, one of which is described as "the Great Comet of 1843," discovered near the *sun's* limb; we enjoyed fine and fruitful seasons: the same in 1844. Here again we have a *singular perturbation in the meteorology of our climate. In* 1818, *it will be observed, our climate was subjected to a severe drought, which preceded the appearance of the great comet in* 1819; *the drought on this occasion occurs in* 1844, *the succeeding year.*

The next year 1845 brings us again into Series X. of the cycle *with its cold spring, gloomy summer, wet autumn, deficient crops. The potatoe disease first made its appearance and brought the direst calamities on Ireland.* In this year "*four comets*" were discovered. The third comet is described by Mr. Hind as being "visible to the naked eye. *It exhibited a tail about* $2\frac{1}{2}^{\circ}$ *long, divided by a dark line into two branches.*"† But during this year neither of these comets appeared to exercise any very great influence on the meteorology of our climate. In 1846 "*eight comets are discovered.*" We have a fine year with heat so intense *that both men and cattle died in several parts of England from its effects, the same as in* 1807 *and* 1825. In the year 1847 "six comets are discovered," and we have a fine season with a bountiful harvest. "*The year* 1848 *again commences the cycle*" with cold and wet seasons.

In 1849, 1850 and 1851 we have three splendid years; in 1849 three comets, 1850 two comets, 1851 four comets are discovered.

In 1852 and 1853 the seasons in both years are wet, cold, and dreary, with deficient crops.

From 1854 to 1859 we enjoyed most splendid years and fine, fruitful seasons. It will be observed in 1857, Series X., we have a singular perturbation: instead of the usual wet and cold season we have a fine spring, hot summer, fine autumn, with an abundant harvest: the same in 1858 and 1859.‡ In 1858 we had a most remarkable "comet;" the influence of this comet on the meteorology of

* We find a similar phenomenon in 1697 of a fine year between two wet ones.

† Altogether singular phenomena.

‡ This perturbation in the climate of England produced a wet cold year with disastrous harvests on the continent of North America in 1858.

our climate must have been immense to have produced such results, and I think furnishes us with the most conclusive data that the cometic system produces a most material influence on the meteorology of our earth.

Following these remarkably hot and fine years, "1860 *again*" *commences the cycle.* The disasters it brought on the English nation are too well known to require further observation.

From the facts already adduced it may be laid down as a rule that, *whenever we have a series of extraordinarily fine, hot and fruitful years, the wet and cold seasons will come on us with a corresponding severity;* for instance, during the years 1807 and 1808 we have remarkably fine and fruitful years, while 1809 is one of great severity; the same phenomenon occurs in 1810 and 1811, followed by the calamitous year of 1812; again, 1814 and 1815, followed by the disastrous year of 1816, and so on through the whole series to the fine years of 1857, 1858 and 1859, followed by the calamitous year of 1860. These cometic perturbations, while they produce intense cold in Europe, as in the winter and spring of 1860 and 1861, cause severe drought in other climates. Our late winter, and the severe drought in India, are evidently perturbations caused by the comet discovered in April 1861, which was visible in the heavens in May the same year.

Many of the comets may not directly influence the climate of England; for instance, there are periodic droughts and famines in various parts of the earth which are not felt in England, and *vice versâ.* Looking at the future from the present year to 1863 there cannot be the least doubt but we shall have very fine and fruitful years, and if so we must expect in 1864 a year with seasons as calamitous *as the late year* 1860. God forbid such a disaster should come on us again so soon! but from the numerous combinations of circumstances, such in all probability will be our position in that year; and even supposing 1864 not to be of the disastrous character of 1816, *then we have to expect two years similar to* 1852 *and* 1853. (See Table.)

With these prospects before us it will be for the wisdom of Parliament and the nation to devise such means as may be requisite to meet these contingencies. We may suggest that a quantity of wheat should be stored in our granaries for these occasions, purchased when the price of wheat is very low: this may be done, and a vast deal of suffering and national loss thereby obviated.

Meteorology of England from 1656 to 1727. Table III.

The cycle in this Table, from 1656 to 1667, is full of singular perturbations; and, unlike any other cycle I can find, it commences with two wet years; these are followed by changeable years as the cycle advances, while the year 1665 brought one of the direst calamities on our ancestors, namely, the "Great Plague of London," in which 68,000 souls perished. I have recorded the price of wheat during that period of our history, which must have been very high indeed.

The first large comet in the Table III. appeared in 1680, and we observe it produced a great perturbation in the meteorology of our climate; it reversed the seasons both in 1679 and 1680, the former a wet cold, the latter a most fruitful year. In 1682 the return of "Halley's Comet" is recorded, which, like its predecessor, brought most splendid seasons, and no doubt caused the great perturbation which followed, namely one wet year, which commenced with a frost so intense that the ice on the Thames was eleven inches in thickness.

In the same cycle we have also another singular perturbation caused by the comet of 1689 (see Table).

In the cycle commencing 1692 we find a similar phenomenon to that in the present century commencing with 1836, namely, between the wet and cold years 1696 and 1698, occurs the fine year 1697, the only one, as far as I can trace, over a period of 200 years.

In 1703 a fine comet was visible in the heavens; the perturbation it produced was greater than that of the comet of 1689, as it appears to have influenced the meteorology of our climate for two years before it arrived.

Meteorology of England from 1728 to 1799. Table II.

In the cycle commencing with 1740, we find two large comets, one in 1742; this and the Great Comet of 1744 brought most splendid seasons; wheat, we find, was only 22*s.* 1*d.* per quarter. The perturbations produced here are of a similar character to others already noticed.

In the cycle commencing with 1752, Halley's Comet returns, but beyond producing fine seasons appears to have caused no other perturbation.

In the cycle from 1764, the comets of 1766 and 1769 produced two most remarkable perturbations. *See Table.*

In 1773 a large comet was visible in the heavens. The wet year was followed by a severe winter, but afterwards with most bountiful seasons for the next two years.

From 1773 to 1780, only two small comets were discovered. The remarkable phenomena occurred which we shall shortly notice.

In 1781 two comets are visible, one to the naked eye. We again find a perturbation, one wet year, instead of two as in the next column.

In 1783 only one small comet is discovered. But a most singular phenomenon occurred, viz., a peculiar haze pervaded the whole of Europe; the sun is described as presenting a deep red aspect: whether this was produced by the comet of 1781 or the small comet of 1783 it is difficult to say.

The next and last cometic perturbation in this Table occurs in 1797, Series X. This comet entirely changed the character of that year; while 1799 and 1800 were both wet and disastrous years, described as "famine years."

Extraordinary Comets.

In 1823, as we have already noticed, we have a most remarkable comet with one tail directed towards the sun, in addition to another in the usual direction. This extraordinary comet produced a remarkable perturbation on our meteorology, giving us a very bad year.

In 1826 five comets were discovered, two of which passed very near the earth's orbit, while one comet passed over the *sun's disk*. In our climate their influence is very perceptible. We had fine seasons, while on the other hand we had a severe winter and cold spring in 1827.

In 1845 a rather remarkable comet was visible to the naked eye. It exhibited a tail about $2\frac{1}{2}^{\circ}$ in length, *divided by a dark line into* two branches. We have this extraordinary phenomenon in the heavens, and we are visited with that calamity which still clings to us, the "potatoe disease."

The Cometic Influence on the Salubrity of our Climate.

In 1831 no comet is discovered: that year brings that disease we only remember with a shudder, the *cholera*, which carried so many thousands of our fellow creatures into a premature grave.

From 1773 to 1780, as we have already noticed, only two comets are discovered. On reference to the Table it will be observed, Mr. Glasher has recorded that during this period our climate was very unhealthy: a great amount of sickness prevailed throughout the land.

It is also a remarkable fact, that previous to the great *Plague of London* in

1665, there was a remarkable paucity of comets, and certainly none of any magnitude. It would appear from this, the cometic system not only affects the meteorology of our climate, but to a great extent the salubrity of the climate itself.

Cometic Visitations Anticipated.

From the great light this discovery throws on the subject, when extraordinary perturbations occur in our climate, we can predict a visit from one or more of these erratic wanderers.

Future Meteorological Observations.

In taking our future meteorological observations, we must watch the Cometary System with the greatest care, and abandon our present system of taking these observations. The Meteorological Department at the Board of Trade and Greenwich Observatory take these observations every two hours; and *The Times* furnishes us daily with a Meteorological Report of the state of the weather from 8 to 9 A.M. It must be obvious to every person who has paid attention to this subject, that we can obtain little or no information from such a system. It is like a man sleeping twenty-three hours, and waking up the twenty-fourth hour to examine the state of the weather.

Why during the twenty-three hours it may have rained, snowed, frozen, or hailed in the interval, and no record kept of these changes. *If we are to get at an ephemeris of our climate we must take each meteorological change at the time the change occurs*, whether in the direction of the wind, barometric, magnetic, or thermometric observations, and note the exact time of each change with the greatest accuracy, not only at Greenwich, but in every town in England. We know it often rains in London, while it is fine at Greenwich, Croydon, Brighton, and elsewhere, and *vice versâ*. Each locality has its own peculiar meteorological changes. In 1859 in the Lake Districts and in the north of England, it rained almost incessantly from New Year's Day till the end of March, while in the south there was but little rain. From these facts it is obvious how highly desirable it is, that the meteorological observations should be taken generally throughout England. Perhaps the town councils in the various towns would appoint a meteorological staff, say, an intelligent person by day, and another by night, to record these changes; any old person past hard work may do all that is required.

Unless we do this, our meteorological observations, as at present taken in one or two places, will only turn out a confused, unreadable, and unmanageable mass

of useless figures. Again, we should endeavour to get meteorological observations taken by the Governments of every nation; and by an interchange of these observations, we should get an accurate knowledge of the climates of our *planet*. And I do sincerely hope our Government will render every possible assistance in this great work, pregnant as it is with the well-being of every nation.

Referring again to the great cometary system, I am inclined to regard this as the great masterpiece of the CREATED UNIVERSE. Our planetary system without the comets would without doubt be subjected to numerous evils which would greatly affect, if not entirely exterminate, the animal, and perhaps the vegetable, world. Well may the heavens drop fatness, and earth and nature array themselves in beauty, to welcome their wandering sisters, and weep floods of tears at their departure for their journey of thousands of years!

THE WINTER SEASONS IN ENGLAND.

The English winter generally is far from being severe; we suffer most from the late spring seasons, which are only just cold enough to make us uncomfortable, and to keep vegetation in abeyance, or to nip off the blossoms from our fruit trees.

In the Meteorological Table I., we observe with what regularity this class of cold springs come upon us. But even our winters are subject to cometic perturbations the same as the other seasons.

In the cycle commencing with 1800, we have *twelve cold winters and late springs*. In the series commencing with 1812, we had *eight cold winters and late springs* against four early springs. The same number in that commencing with 1824.

In the cycle commencing with 1836, *we had nine cold winters and springs* against three early springs. From 1848 to 1859 we had only *seven* cold winters and springs. With five early springs throughout this cycle the cometic perturbations are very great. The severe winters like 1860 and 1861 are also attributable to the same causes, aided to a certain extent perhaps by planetary conjunctions.

The severe cold we experienced at the commencement of 1861 is not so intense as the winters in Germany, North America, and other latitudes. With a regular German or North American winter we should perish in our wretchedly built houses.

If we have ice from ten to eleven inches thick, this is a terribly cold winter. But the ice on the Danube almost every year is from three to four feet thick,

so intense is the frost. And this continues from three to four months every year; consequently our so-called cold *severe winters are only the fag-end of a German winter.* It is only termed a severe winter *in England if the Thames is either frozen over, or the river blocked up with ice.* Taking this as our standard, it will be seen from the following dates, we do not experience severe winters very often in our climate.

Severe Winters in England.

1683	Ice 11 inches thick on the Thames;	Great Comet, 1680.	
1716	Severe frost;	Thames frozen over;	Cometic perturbation.
1730	,,	,,	,,
1740	,,	,,	,,
1762	,,	,,	,,
1789	,,	,,	,,
1795	,,	,,	,,
1814	,,	,,	,,

1839, 1845, and 1860—61, also severe winters produced by Cometic perturbations.

The Planet Saturn.

The influence of Saturn appears also most mysterious: in 1860, this planet is in the constellation of Leo, with Jupiter entering the same constellation; the heavens pour down a deluge of rain. In 1845 (see Table, Series X.), Saturn is in opposition; we are visited with that terrible scourge the "potatoe disease." In 1830 this planet is again in Leo. In 1831 we are visited with that awful pestilence the cholera, which raged in almost every part of the world. In 1815 this planet is again in opposition, and in 1816 the heavens pour down torrents of rain; in 1800 this planet is again in Leo, and both 1799 and 1800 pour down their furious calamities in a deluge of rain. Tracing this planet still further back, we find it in 1665 in opposition; that year brought on our country one of its direst calamities, "the Great Plague of London."* Still with all this it does not appear that this planet influences the meteorology of the earth to the same extent as the planet Jupiter, and from what we have

* We know all the theories advanced from time to time as to the causes of the potatoe disease, the cholera, and the great plague of London, have only tended to make confusion worse confounded, and up to the present day the subject is shrouded in a profound mystery; but, without doubt, like the extraordinary periodic rotations of wet and cold years, they are sent for some great and beneficent object.

before stated, the wet cold years with which we are visited, in my humble judgment, are more from the direct influence of the planet Jupiter and the cometic perturbations, than from the planet Saturn; but we must take all the circumstances into consideration in future investigations.

The Planet Uranus.

The planet Uranus completes her revolution round the sun in 84 years. In the year 1703 a most dreadful hurricane occurred in England. 84 years after, or in 1787, a great tempest raged over England and France. If these meteorological phenomena are caused by the influence of Uranus, we must expect a similar gale or tempest in 1871.

The Meteorological Order of the Earth.

In the cycle of years nature's laws are in mercy so arranged that every portion of the earth should not be afflicted at the same time. For instance, three years ago, in 1858, a failure of crops fell on America, *which equally affected the price of food in England.* In 1860 the harvest in England is most disastrous, while in America most abundant, whence England is now receiving immense supplies of food to supply her deficiency, but causing a drain of England's gold. One year the South American continent may experience disasters with its cotton crop, while the cotton crop may be most abundant in India. The present famine in India greatly afflicts England. Consequently, let these calamities fall in almost any part of the world, whether it be in silk, sugar, or any other branches of commerce, the interests of England are equally involved.

Man's notion of security is in concentration: nature's laws in extension. In this cycle of years and the cometic perturbations, we have "the great law of the dispersion of the human race" over the whole earth: without doubt the original cause of this dispersion of the human family was famine in the land of their birth. Therefore, for England to attempt to depend on America for a supply of cotton is sheer folly, and if persisted in must inevitably bring terrible disasters on England. The same with every other article of daily use: the only security for England's prosperity is to encourage in her vast colonies the growth and supply of the raw materials she requires in her commerce and manufactures; then Christianity and patient industry will go hand in hand with increased happiness for the great human family. As regards the diseases, such as plague, cholera, &c., which afflict the human race, an all-wise Providence, without doubt, has placed at

our command the means of counteracting their baneful influences. If the vegetable world is afflicted, as illustrated in the potatoe disease and silk crops, and we use our best endeavours, we can, without doubt, find counteracting elements to arrest these ravages.

But to place us in perfect security, and fill England's barns with plenty, so that there may be no lack of bread for her sons during the year's scarcity. *We know we have the means of doing this at our command*, and thereby protecting England's health, and wealth, and general prosperity. To this subject the Appendix to this work is chiefly devoted, to which I not only call attention, but also for a hearty response to the invitation ; and when once in operation, we can not only look calmly on while the earth takes her periodical bath and nature renovates herself, but patiently wait the return of plenty and prosperity, and leave foreigners to their own resources. For our agriculturists, manufacturers, and merchants to be able to anticipate the seasons of each year, must be of incalculable importance, not only to their interests, but to the nation at large ; and it is hoped our working classes will take warning, and put their houses in order, and be prepared for the approach of these events.

Every nation on the earth will equally look to its interests, and be likewise prepared as far as possible to discharge their new duties, and to meet all contingencies. *The Times*, in one of its leading articles, adverting to the calamities of 1860 and the spring of 1861, stated, "All the philosophy of the age failed to explain the phenomena satisfactorily." But it has now pleased Almighty God that I should be the humble means in His hands, if not entirely to solve this great question, at least to discover the key to the solution of the problem, which has remained, for want of an observer, upwards of 6000 years a mysterious secret. It opens up a vast field of investigation; another curtain is now withdrawn, and as we gaze on the panorama before us, wonder upon wonder bursts on our astonished vision. The storms which sweep with terrific violence over land and sea, the deluges of rain which bring their terrors, and threaten almost our very existence, the famines which desolate the plains of India, and carry off thousands of our fellow subjects by all the horrors of starvation, are all spread out as it were on a map before us, if our past observations had been taken sufficiently accurate for our guidance. But I fear from our past neglect that opportunity is "irrevocably gone;" we must wait for years again to roll by before it can again be obtained. Still we have enough at present to guide us, and what we further require, we must patiently wait for, until it is again revealed to us in the succeeding rotation of years, and by making our observations in future in accordance with the information we wish to obtain.

If we as a Christian nation fell down on our knees in humiliation and supplication before the Almighty, when these great calamities overwhelmed us, ought we not to return our humble and heartfelt thanks to the same Divine Being for opening our understanding, and revealing this knowledge of his great and mysterious laws to us, so that we may learn from the past how to prepare for these heavy calamities when they come on us? We can now put our house in order, and thereby soothe many sorrows and dry many tears: having done this, we can patiently wait the return of prosperity and plenty.

I feel overwhelmed at the magnitude of this discovery, and at the new duties which now devolve on each one of us if we are to protect the wealth and homes of England. But let the task be boldly met, and we shall find for every thorn in our path a sweet-scented blooming rose, and for every briar a myrtle tree, to make our duties and labours pleasant. For if the humble philosopher's labours are severe in investigating nature's great laws, how stupendous the reward! It has been said science is a hard mistress: this is not true; it is man who is hard and selfish. Be that as it may, she is a loving companion, a faithful friend, a graceful benefactress: whether we soar into the recesses of the starry firmament, or dive into the bowels of the earth, she is our best and most faithful guide; by her we learn lessons in the stones of the field, and wisdom out of the dust of the earth; the man who attempts to pollute her sanctuary and pervert her laws brings confusion on his own head, and shame on his own actions. Having now linked the planetary and cometary worlds in connection with our fair earth, I now conclude this part with the pathetic words of the immortal Kepler:—

"Nothing hold me, I will indulge in my sacred fury. If you forgive me, I rejoice; if you are angry, I can bear it. The die is cast; the book is written, either to be read now or by posterity, I care not which. It may well wait a century for a reader since God has waited 6000 years for an observer."

APPENDIX.

ENGLAND'S POSITION AND ENGLAND'S ONLY HOPE.

PART II.

ENGLAND'S POSITION WITH A BAD HARVEST.

During the late war in the Crimea, our brave army neither feared the foe nor death, but the iron hand of famine entered its very soul.

The position of England in reference to her agriculture, manufactures, and mercantile interests, is peculiarly critical. With a so-called bountiful harvest from our own soil, and a great deal of provisions imported from other countries, we manage to go on comparatively smooth: but with a deficient harvest, the position of England is not only fearful, but it is humiliating and perilous in the extreme; every interest is touched in its most vital part; in fact, our whole moral and social system receives a rude shock. The position of the farmer during the year of 1860 was severe in the extreme. It commenced with cold weather, which continued for many months; in fact, we may say there was no spring season at all. The farmer was deprived of his early pasturage; the result was a great scarcity of food for his farming stocks, and thousands of cattle died from sheer starvation, both in England, Ireland, and Scotland. This loss of agricultural live stock produced an almost famine price of animal food for our population.

The cold spring was followed by a wet summer, but fortunately after the hay-harvest was over, and as grasses love plenty of moisture, the pastures were most abundant for the cattle to the end of the year. Then came the gloomy autumn, the grain crops both deficient in quantity and quality; in addition to this all the expense of keeping the workmen about them to take advantage of every bit of sunshine to house the crops.

We next come to the manufacturer's position during the same year. His mills toil on, and he has hopes to find purchasers for his manufactured goods, but suddenly he finds his vast establishments, with his well trained and skilful workmen, brought to a sudden halt; his warehouses are full, and no purchasers. He hears,

perhaps, that, from the pressure of circumstances, his oldest and best customers, unable to meet their engagements, have suspended payment; trade is paralysed: to add to this state of perplexity, the workmen in their hours of distress, without inquiring into the cause of their misery, are led away by wily agitators to ruinous strikes, as they foolishly imagine, to protect their interests.

The merchant from the same causes has his vast piles of goods in the dock warehouses, which he can only dispose of at a great loss; while to keep them on hand, with the rate of discount at the Bank of England at 8 per cent., is also a great loss. The result is, the hard earnings of years' industry vanish like smoke in the raging storm. Then follow the consequences. (See letter to the Right Hon. Lord Calthorpe, page 61.)

If, therefore, years like 1860 bring most disastrous results, not only on the interests referred to, but on the nation at large, it must be of vital importance to anticipate these dread years, in order to be prepared for coming events.

For the farmer to be able to anticipate the character of each season of the year must be of the utmost importance in his farming operations. He can make his arrangements without fear, and lay up his produce for more remunerative seasons, while he will be able to take time by the forelock, and fill his barns and stores for the sustenance of his stock during the cold winters and late spring seasons. It will teach him when to sow with a sparing or with a bountiful hand, and to make arrangements to secure his crops in best order during the wet seasons of harvest, as science and experience may best teach him.

If this information is valuable to the farmer, it is a thousandfold more so to the mercantile community. It will prevent the many unprofitable speculations into which merchants at times so over confidently embark their capital, only to find all their plans frustrated, and the goods from which they hoped to realise a good profit become a drug in the market, to be disposed of at a ruinous loss.

But facts are better than theories to illustrate the benefit the merchant can derive from this discovery. During the autumn and part of the winter of 1858, we experienced a severe drought throughout England. At the close of autumn, the pastures were "*literally burnt up*," the farmers began to tremble at their position, and if a severe winter had followed that drought, a great mass of the farming stocks of England must have perished from sheer starvation.

The merchant seeing the position of the farmer with an eye to business, and calculating on immense profits, large orders were sent to India, the Baltic, the Black Sea, and other places for linseed, linseed cake, Indian corn, &c. &c.: when these immense consignments arrived, they were not required, but became

a drug on the market and a great loss to the importers. Many merchants in the City will confirm this statement.

If we refer to the Meteorological Table, Series XI., in which we find 1858, it will be observed in this series we have generally very "mild winters" with very early springs. But in 1858 the winter was so mild that in December and January the pastures throughout England were most abundant, and so they continued throughout the succeeding year. If the merchant had been able to look into the future, as we are now able to do, he would have moderated his expectations and saved both his time and capital, while on the other hand, the farmer might have smoked his pipe in peace by his fireside, well knowing he had nothing to fear.

Again, a few years ago, (I forget exactly the date,) some of the Liverpool merchants had speculated largely in wheat, and perhaps, if not fondly, at least fully expecting a wet autumn and a deficient harvest in England when the grain arrived. To the dismay of the unfortunate merchants, the sun continued to shine brilliantly. A golden harvest waited the sickle, and the heavens were without the appearance of a threatening cloud of the size of a man's hand. Finding their speculations a failure, they resorted to a stratagem of tampering with the barometer in the Corn Exchange rooms, with the hope of sending up the price of their grain; the mercury in the tube fell to an alarming extent: still bright Phœbus continued to pour down her brilliant rays with more vengeance for each fall in the barometer. The good people in Liverpool not in the secret as to the cause of this mysterious barometric and meteorologic struggle were sorely perplexed, and thought something must be wrong: one a little more shrewd than the rest detected that the mysterious barometric influence extended only to the limits of the Corn Exchange. The fraud was discovered; a strong box was placed over the mercury cup of the barometer in the Exchange rooms, and made fast with a Bramah lock.

The barometer, secured from further insult, resumed its honest course, faithfully recording the atmospheric variations, and left the speculating merchants to make the best of their bad bargain. I simply record these facts for the purpose of explaining the great advantage the merchants, both buyer and seller, will derive from the discovery now placed at their disposal. Lastly, we know from past experience these wet seasons and deficient harvests cause a drain of gold, a general depression in every branch of commerce, and a scarcity of labour for our working classes. But as we can now anticipate these events, the manufacturer and the merchant can arrange all their affairs in accordance with the approaching seasons, whether of abundance or scarcity, and thereby go into their speculations with com-

parative security, and each class of the community will likewise know what they are to expect, and act accordingly.

A word to the working classes. A few weeks ago a sketch appeared in *Punch*, with our witty friend himself standing in the centre of the picture, pointing to two institutions, the one "the great curse of the land," which brings degradation and shame on all who frequent them:

> "The constant visitor there
> —— leaves hope behind him."

I allude to the "Beer and Gin shops." Look not there, but on that other institution, the "Savings' Bank;" put your small sums in there during the years of prosperity, and you can defy the storm when adversity comes, and wait patiently the return of prosperity.

We now come to another inquiry which requires the profound attention of all classes of our countrymen. In our age we have either too many false prophets or too many credulous fools: no sooner does any event arise than we have some wild theory advanced, if in monetary matters, by political economists. And if I am correct *The Economist* is responsible for the following brilliant and comforting statement. In an article on the drain of gold to purchase foreign food we are assured with that gold "foreigners will purchase our manufactures, and consequently it will flow back to England again in a very short time!" If this is not the fool's paradise facts go for nothing. In an article on the drain of gold from England, *The Times* states, "for the *ten* months ending 10th December, 1860, England had paid 22,862,916*l.* for grain, corn, meal and flour imported into England." *

* This sum will no doubt be swelled to the enormous sum of £32,000,000 before the harvest of 1861 is ready for the market.

We find the following in the *Moniteur*: —

"One of the most remarkable items in the receipts of the English Treasury in the last twelve months is that of a sum of £860,000 for duties on the importation of foreign corn. It is generally, but erroneously, believed, that grain imported into England is admitted free; but a tax of 1*s.* per quarter is imposed, principally to enable correct statistical returns to be obtained respecting this branch of commerce; and yet such was the importance of the trade that the said small tax produced £860,000. To realise such a sum the importation of foreign grain into England cannot have been less than 16,000,000 quarters, one quarter being rather less than three French hectolitres. The average price being 30*s.* the quarter, England must have paid during that period £24,000,000 sterling for the grain necessary for her subsistence. This fact will give a just idea of the deplorable state of the last harvest, and at the same time it explains the diminution which has taken place in gold and silver coin in England."

The nations which supply us with grain to any extent are Germany, Russia, Belgium and America. If we turn to our export trade returns, we fail to find a corresponding increase of our yearly exports to any one of these places. Our imports from Russia gradually increase every year. Our exports to the same place remain nearly stationary: the same to Belgium and Germany. And now America virtually closes her custom-house door against the introduction of our manufactures. But the political economist again comes forward, and assures us if the Americans close their ports against us with prohibitive tariffs, our manufactures will be smuggled across the frontier. Well, the less said about such a trade the better. In a country like America with a free press, we know every inch of the frontier will be carefully watched, and any open part will soon be exposed the moment it is known an illicit traffic exists in that direction.

America is now opening our eyes: she is telling us in plain words, we can now do without your manufactures, while we know you cannot do without our grain. "*Without us you will die for want of food.*" While each bad harvest with you brings us increased riches here, we only want your gold, keep your manufactures at home.

When foreigners come to England, they visit our various manufactories, notice the wealth of the cotton lords; they see persons who, only a few short years ago, were working mechanics, and they now see before them men of great wealth, with hundreds of workmen in their employ. The foreigner returns home with his ambition fired, and commences as a manufacturer; his countrymen, however, prefer English articles: he is equal to the task. Finding his goods do not go off in the market, he stamps the name of some well-known English firm on his inferior manufactures; the market is at once open to him; the fraud serves to bring English manufactures into contempt; this being done, other imitators like himself come into the market; to all appearance they produce an article equal to English manufacture, and the cry is at once raised for a prohibitive tariff against English manufactures. Go into Russia, Germany, Austria, America, or France, and you will find this to be a fact; in each of these nations manufactories are springing up in all directions, and with the very gold sent out of England to buy foreign food. If we want further proof of this, let us take the monetary position of this country as compared with America, Germany, Russia, or Belgium, in the spring of 1861. In England the Bank of England rate of discount is 8 per cent., in Belgium 3 per cent., in Germany $1\frac{1}{2}$ per cent., while in America the coffers of the banks are overflowing with gold sent from England, which will not return to this country to purchase our manufactures, but it will be employed to build factories in those same countries, to

drive our manufactured articles out of the market, and thereby crush our trade: while famine and stagnation here drive our best and most skilful workmen to emigrate, and thereby turn their ingenuity against England. It may be said the world is large enough for all: true it is so, but England must not be dependent on other nations for food, if she is to keep up in this race with her present heavy taxations and responsibilities. We frequently hear this expression by some of our enthusiastic manufacturers, "Sir, we can manufacture goods for the whole world." True; but each nation of the world now prefer manufacturing for themselves, and England, as we have seen, furnishes them the means of effecting their object; in a word *supplies them* with the sinews for this war of competition.

I stated in the preceding pages, "But to place us in perfect security, and fill England's barns with plenty, so that there may be no lack of bread for her sons. *We have the means of doing this at our command.*"

And now for the secret, (turn your noses up at it as you may!) it lies in this one question,—THE APPLICATION OF SEWAGE OF OUR TOWNS FOR AGRICULTURAL PURPOSES.

"The very substance which is pollution to you in one place, would be salvation to you in another. The sewage of your towns well bestowed will relieve you from all anxiety, and preserve the fertility of your soil, and the strength of your population from impoverishment and decay." (*The Times*, 23rd Dec. 1859.) Never were truer words uttered. To *The Times* I must express my humble thanks for the great and enlightened views it has taken of this important question. *This is England's only hope*, if she wishes to protect her wealth, increase her prosperity, and establish her entire independence of the foreigner for the very food she consumes; and the sooner the work is commenced, the better it will be for the interests of every one of us. England's destiny is in her own grasp, either to maintain her high position or to resign that wealth and power into other hands: she must make her choice; there is no alternative. Look at the meteorological table and you will see what is in store. To expect nature to suspend her beneficent laws would be futile, and to expect a soil deprived of the elements she gives in the shape of food to be fruitful is equally hopeless.

The great laws of nature, like man, manufacture from the "raw materials." Deprive the soil of the elements out of which it manufactures its food for man, it becomes a sterile waste. All the food we consume comes from the soil, and after passing through the human body it contains the same elements as when in the shape of food, or, after the process of digestion, it is again reduced to nature's "raw material," and consequently ought to be returned to the soil.

If a manufacturer is deprived of his raw materials, we know the result: he comes

to ruin. The same with the soil. We throw away our sewage at home, and we pay some 3,000,000*l.* per annum for manure we fetch some 15,000 to 16,000 miles. With all this expenditure we are nearly starving: a bit of animal food is now a luxury to thousands.

If we outrage nature's best laws, we must expect nature's severe chastisement. The laws of nature's agricultural operations are most precise; she returns to the soil all she receives from it. If we examine the vast prairies or the primeval forests of America, where man's foot has scarcely ever trod, and certainly his selfishness never polluted, we look in vain for one solitary trace of decay: instead of deterioration, we find everywhere increasing fertility, although the vegetation is in active operation: but there is no waste, the prairie grass and gigantic trees there come to maturity, fall, and return to the soil, and out of old death new life springs forth in all its beauty and luxuriance—this is nature's notion of agriculture. Man's notion is to get as much as possible from the soil, while he gives back with a niggardly hand, and then complains of the unproductiveness of the soil. The food consumed by man is the earth's choicest production, the highest order of both the animal and vegetable world. If those choice elements from the soil are changed into *poison*, as some people would have us believe, instead of man being regarded as the most perfect of created beings, we must regard him *as the foulest, filthiest and most corrupt of the animal world.* We return the excrements of animals which exist on inferior food to that of man to the soil, while that of man, which contains the richest fertilising elements, we throw into our rivers, and in a great many instances do not scruple to drink the waters we have polluted with this *so-called poison.*

The sewage of our towns consists of: —

First. Human excreta and urine.

Second. The wash, slops, and soapsuds from our houses.

Third. The water used in cooking and culinary purposes.

Fourth. The street-washings, the horses' water-closets.

Fifth, the refuse from manufactories, &c., &c. From frequent discussions with persons on this subject it is only the excreta which they seem to regard as *poison.* Well, I have seen a pig eat it, and a lady's pet dog lap it up and lick his mouth after with an apparent relish. I have known the same pig, *not poisoned*, but fattened and killed, and I have enjoyed a hearty breakfast from a slice of the *ham.* I have seen the pet lap-dog, *not poisoned,* but in the enjoyment of perfect health. We all know that ducks revel in the slush from the house, but none of us

ever think of turning up our noses at *duck and green peas.* Some will say on reading this, "you nasty thing:" be it so. But we must meet absurd theories with "plain facts."

Others ask, if you distribute the excrements from the towns over the fields, will it not poison the atmosphere? The reply is, Do not the excrements *lie by the tons* in the cesspools within a few yards of almost every dwelling? No one ever dreams of its polluting the atmosphere, or being prejudicial to health.

Again, if an atmosphere densely impregnated with the vapour from the sewage was prejudicial to health, we should imagine the men who traverse continually the vast network of the London sewers would be great sufferers; but we fail even there to discover a trace of any ill effects on the health of the sewer men.

In the remaining component parts which constitute the sewage of our towns we shall search in vain for poisonous ingredients; while on the other hand, we find it to contain the highest fertilising elements. A short time ago, in a rather lively discussion, I made the following statement in *The Times*, that "*each person residing in a town would keep his acre of land in the country in a high state of cultivation.*" For this assertion I find I have been rather severely taken to task by Doctor Shorthouse, of Carshalton, Surrey, and in the following not very complimentary language:—

"To talk of applying the sewage of Croydon, the drainage of which town "extends to 20,000 inhabitants, to 9000 acres of land may seem a bold assertion, "but it is a still greater fact that each person will furnish sufficient sewage to "manure an acre of land. Nobody but a shallow enthusiast or a dreaming idiot "could believe in such wild bubbles. As the scheme is now begging for a trial "from each of you, I thought you might profit by *my experience*, which costs you "nothing, rather than purchase experience for yourselves at a dear rate."—Extract from Dr. Shorthouse, &c. &c., Lecture on High Farming at Croydon, 22nd December, 1860.

I have read somewhere of a dragon of old having many heads and horns, a crown on each head, and of his dragging many stars after him with his tail: he must have been a formidable customer; and if I am correctly informed, Doctor Shorthouse, &c. &c., is considered a very scientific personage; in addition to the *medical profession* he drags a large but carefully selected portion of the alphabet at the tail of his ancestral name, denoting the numerous learned societies of which he is an eminent member. Now with all this scientific prestige, one would naturally have expected the eminent scientific doctor would have given chemical facts and

figures, and supported his arguments from chemical deductions: instead of this, however, we only get a random statement, unworthy, nay, an insult to the sacred name of science.

Now I made the statement that the sewage of one man will keep an acre of ground in a high state of cultivation, and it is supported by facts and data given by the highest agricultural authority of the age, viz.:—

Professor Way, Agricultural Chemist to the Royal Agricultural Society, states, "The excreta and urine of one man amounts to $3\frac{1}{4}$ lbs. daily; then $365 \times 3{\cdot}25$ "gives 1186 lbs. or upwards of $10\frac{1}{2}$ cwts. per annum for one man, the weight of the "excreta and urine alone, containing 3 per cent. or 35·85 lbs. of nitrogen, which, "according to Boussingault's estimate, is sufficient to grow upwards of 1600 lbs. of "wheat, rye or oats, or 1800 lbs. of barley.

"In respect to the quantity of nitrogen contained in excrements, 100 parts of "the urine of a healthy man are equal to 1300 parts of the fresh dung of a horse, "according to the analysis of Macaire and Marcet, and 600 parts of the fresh dung "of a cow. The powerful effects of urine as a manure are well known in Flanders, "and these are considered invaluable by the Chinese, who are the oldest agricultural "people we know: indeed, so much value is attached to the influence of human "excrements by these people, that the laws of the state forbid that any of these "excrements should be thrown away, and reservoirs are placed in every house, in "which they are collected with the greatest care."—*Liebig's Agricultural Chemistry*, p. 190.

Now I believe most of our farmers consider 3 cwts. or 336 lbs. of guano to the acre a good dressing or manuring for the land, and after this manuring they expect to take four crops from the soil before they manure again.

The guano imported into England on an average contains under 10, and in too many instances not more than 7, per cent. of ammonia; consequently, 336 lbs. of guano would contain only 33·6 lbs. of ammonia, equivalent to 27·23 lbs. of nitrogen. But if an adjoining acre of land received the excreta and urine from a healthy man for four years, the result from Mr. Way's experience would be as follows:—

	lbs.	years	lbs.		lbs.	
From the man,	1186	× 4 =	4744	of excreta and urine containing	142·32	of nitrogen
				From 336 lbs. of guano only	27·23	„
				Difference	115·09	„

Or the acre of land manured by the man would receive upwards of 500 per cent.

more nitrogen than the land manured with the 3 cwt. of guano, to say nothing of the phosphates, &c.

But the advantage does not end here. In addition to the excreta, we know a man requires his clothes washed; from this operation there are the soap-suds, containing soda, potash, and fatty matter*; then the water used in cooking his food, and the wash from his dinner plates and dishes, &c., all of which is strongly impregnated with vegetable and animal compounds; then again the soap used in the operation of washing the person, baths, &c., and this we may take at *six gallons* per day; therefore

days		galls.	galls.	years	galls.
365	×	6	= 2190	× 4	= 8760 per annum

to be added to the excreta; we have 8760 gallons of highly fertilising manure, or nearly two gallons to the square yard; and if the excreta and urine is mixed with this mass in its liquid state, it will be in the best state for assimilation with the soil: or if we take the sewage from 365 persons for four days, which is equivalent to the sewage from one person for four years, such is the mass the acre of land would receive: the comparison is obvious.

We also know when a person rises from his dinner he frequently leaves a quantity of bones on his plate, which amounts to many lbs. in the course of the year. In Liebig's Chemistry of Agriculture, p. 192, it is stated that 100 *parts of dry bones must* be equivalent to 250 parts of urine.

From these facts we can form some idea of the immense mass of manure absolutely wasted from every farmstead in England, which, if collected, and thrown over the land near the house, the benefit the farmer would derive would be immense. The cost of collecting this manure for distribution need not exceed £60 for each farm. The only way to get this into general operation would be for the landlord to go to the expense of the requisite machinery, and charge the farmer interest and 10*s.* per acre as additional rent on all the lands over which it can be distributed. No steam machinery is necessary for this operation.

We never hear of the Chinese importing guano: but we do learn from Sir John Bowring, and even from that careful observer, the late and lamented Mr. Bowlby, *The Times* correspondent in China, that the excreta is used, and of the pastures and grain crops being most abundant.

* For analysis of food and excreta, see Liebig's Agricultural Chemistry.

"Time was ere England's grief began,
When every rood of ground maintain'd its man;
But things are changed, for now 'tis found
Every man maintains his acre of ground."

Mr. Bowlby remarked, "This is literally true here in China." We are further informed that in Pekin the excreta while fresh is kneaded with clay, and sold as an article of general commerce.

But Doctor Shorthouse, &c., further states,—here are his own words,—"The result has satisfied me that 100 acres of land will 'use up' all the manurial properties of the Croydon sewage." What results, Doctor?

The drainage of Croydon at present extends to 20,000 of its inhabitants; therefore, exclusive of the daily visitors from London, we may take on an average, each person voiding $3\frac{1}{4}$ lbs. daily, excreta and urine:

$$\text{or} \quad \overset{\text{persons}}{20{,}000} \times \overset{\text{lbs.}}{3{\cdot}25} = \overset{\text{lbs.}}{65{,}000} \text{ of excreta and urine daily; then}$$

$$\overset{\text{lbs.}}{65{,}000} \times \overset{\text{days}}{365} = 23{,}725{,}000 \text{ lbs. of excreta and urine}$$

containing 711,500 lbs. of ammonia, equivalent to 975,145 lbs. of nitrogen per annum. Again, allowing six gallons of water to each person for the purpose before described, we have

$$\overset{\text{persons}}{20{,}000} \times \overset{\text{days}}{365} \times \overset{\text{galls.}}{6} = \overset{\text{gallons}}{43{,}800{,}000} \text{ per annum;}$$

besides this, there is the vast mass of sewage from street washing, house washings, and other sources, altogether about 1,500,000 gallons per day. All this Dr. Shorthouse would put on 100 acres of land! Well, Doctor, it would be a terrible physicking!

Having placed these facts before the reader, I must leave the doctor to his fate: but before doing so, I cannot but express my surprise at the present state of medical science. How a medical man can pretend to administer medicines to eradicate diseases the human frame is subjected to, with all its delicate organs, while in a state of the most complete ignorance of the chemistry of the food which sustains the body,—this, I must confess, is to me a most profound mystery. "Medical science" cannot be a profession, it seems only a "trade," if Dr. Shorthouse's expressed experience is to be taken as a criterion.

Now for the capabilities of the sewage as a fertiliser.

THE SEWAGE OF OUR TOWNS FOR AGRICULTURAL PURPOSES.

"The Dirt of our Towns ought to be on our Fields."—LORD PALMERSTON.

Speech of Mr. George Shepherd, C.E., delivered at the Society of Arts, 7th March, 1860.

MR. SHEPHERD, C.E. said he had listened with deep interest to the very able paper read by his friend, Mr. Mechi, on the great question before the meeting. It was a subject to which he had devoted a great deal of time and enquiry, as would be seen from his writings—"THE LONDON SEWAGE, AND ITS APPLICATION TO AGRICULTURAL PURPOSES," (published by Effingham Wilson, Royal Exchange). This subject has been so long before the world, that he thought all practical farmers and scientific men were agreed as to its manurial value. But two opponents have sprung up at this eleventh hour to raise their voices against its use for manuring our fields.

The opponents are G. P. Bidder, Esq., President of the Institute of Civil Engineers—the other, Mr. Hawksley, C. E., of Serpentine notoriety. Mr. Bidder, in his address from the chair of the Institute of Civil Engineers, said:—"One great inducement hitherto held "out has been the prospect entertained of employing the sewage of our towns for fertilising "the neighbouring lands; and it is mainly due to our member, Mr. Hawksley, that this "*delusion*, to a great extent, has been dispelled. Recent investigations have shown that in "towns amply supplied with water the sewage contains very little, if any, fertilising quality; "certainly none of commercial value. Indeed, a careful consideration of the economy of our "rivers might have anticipated such a result—and that water will purify itself."

On reading this astounding paragraph in Mr. Bidder's address, and knowing, at the same time, that Mr. Hawksley's *recent investigations* were quite at variance with *the experience of other people*, I wrote to Mr. Bidder—and, at the same time, enclosing various documents showing the manurial value of our town sewage, and where it had been applied to the land with the most extraordinary results. I asked, in return, to be favoured with a copy of Mr. Hawksley's report on the sewage, showing *how*, where, and when he had made these investigations so at variance with recent facts. I believe my friend, Mr. Mechi, wrote for information on the same subject. But both Mr. Bidder and Mr. Hawksley remain silent—perhaps the best thing they could do, under the circumstances.

I shall now proceed to lay before the Society the composition of our town sewage, its chemical effect on the Thames water during the summer months, and the commercial value of the sewage when applied to fertilise the soil.

From the returns just published by order of the House of Commons, on the supply of water to London, we are informed that the various water-works supply London daily with, in round numbers, about 80,000,000 gallons of water, or about equal to the water pumped daily out of half-a-dozen mines in Cornwall.

Assuming these figures to be correct, from a series of experiments I have made, extending over nearly three years, I find the water supplied is consumed as follows:—

About 25 per cent., or 20 million gallons of the daily supply, is consumed in various household uses, drunk by animals, evaporated, used for watering roads and for manufacturing purposes; this amount disappears entirely.

About 60 per cent., or 48 million gallons, goes into the sewers, after it has been used for the various household and other purposes, viz., washing clothes, dishes, cooking utensils, the wash and slops from the bed-rooms, water used for cooking, washing the person, &c. In addition to this, there is the wash from the slaughter-houses, gas-works, manufactories, and various other places, too numerous to mention. These 48 million gallons of water, consequently, contain all the soap, soda, potash, fatty matter from every dinner-plate and cooking-pot, the water used for cooking food of every kind, besides valuable slush of every character; from all possible places—all of which contain ingredients of animal and vegetable matter of the highest fertilising character, some of it too rich for grass-land, and would require further dilution with water before it could be applied; for instance, take what is called *soap-suds*, apply it to grass-land in its full strength, and it will burn the vegetation up; but dilute it with twenty times its volume of water, then apply it, and the vegetation will thrive most luxuriantly. From numerous experiments, I am convinced that this mass of sewage is equal in value to the water-closet sewage itself.

Lastly. About 15 per cent., or 12 million gallons of water, goes through the water-closets, carrying with it into the sewage all the excrements from nearly three millions of human beings, the inhabitants of London. Taking the excrements (fæces and urine) at $3\frac{1}{4}$ lbs. daily from each person, this 12 million gallons contains about 9,750,000 lbs., or 4,352 tons of excreta daily, in the best state for assimilation with the soil. Therefore, scarcely a gallon of water goes into the sewers which does not contain valuable manure more or less.

Such is the composition of the sewage, and, as will be readily understood, it is rich in soda, potash, phosphates of every kind, which the land requires for the nourishment and growth of the plants, and in its liquid state is best adapted for assimilation with the soil. See analysis in Liebig's Agricultural Chemistry, pp. 260, 261.

The last few years, during the hot and dry summer months, the intolerable stench from the Thames, caused by the sewage, was traced over its surface to a distance of upwards of 40 miles. Now, if we take the average width of the Thames at 1,500 feet wide, 20 feet deep, and 40 miles in length, or 1,500 feet wide, 20 feet deep=30,000 feet sectional area, by 40 miles, would give a mass of water equal to 6,336,000,000 cubic feet. Now, during the hot and dry months in summer, the quantity of sewage discharged into the river does not exceed more than from 7 to 8 millions cubic feet per day. Now, if the sewage is so innoxious, and contains no fertilising matter, how is it that this comparatively small quantity of sewage daily possesses the power of putting this 6,336,000,000 cubic feet of water in such a state of fermentation that, during the summer months, it is scarcely possible for the people to reside on its banks, the Houses of Parliament to carry on their deliberations, or for the community to travel on the water in the steam-boats, without being almost suffocated? and, even in the winter months, when the flow of water downwards is most abundant, the river remains in the most filthy state—its surface and banks are covered with human excreta, fatty matter, and refuse filth of every kind.

If the sewage is so innoxious when highly diluted with water, how is it that Mr. Hawksley

has been appointed *wet nurse* to the Serpentine in Hyde Park, and, in that capacity, he has proposed steam-engines, filtering-beds, sewers, culverts, &c., &c., to assist his patient to get rid of her dirt and filth? It is true, water will purify itself, if a stream is polluted; but, during the operation of self-purification in hot weather, it will fill the air with pestilential vapours, the houses of those who are compelled to reside on the banks of the stream with disease, lamentation, and woe—such is the chemical effect of the sewage of our towns on the fair streams of England at the present moment.

Mr. Bidder states, "In towns amply supplied with water, the sewage contains little or no fertilising quality, certainly none of any commercial value." I think the following facts will show *the delusion* exists only in Mr. Bidder's address and in Mr. Hawksley's recent investigations, and not in the commercial value of the sewage. But let us see

The effect of the sewage of Ashburton, Devon, as described by H. Caunter, Esq.:—

"As an illustration of the extraordinary effects of sewage water, even in a highly diluted state, I will mention that beautiful valley in Devonshire immediately below the little town of Ashburton. The stream of water which runs through the place receives all its sewage and the wash of two or three manufactories, and is afterwards by a well-arranged system made to irrigate the valley below for nearly three miles in extent, until it falls into the river Dart. The produce of this valley is perfectly astounding, and no stranger can ever pass along the high road from Ashburton to Buckfastleigh without being at once struck with the luxuriance and abundance of the pasture around him. The average rental is about £6 per acre; but it sometimes lets at fabulous prices, especially in a late cold spring. The last meadow is as good as the first. The water rises on the high moorlands; it is of no use for irrigation, but absolutely injurious to the soil before it receives the sewage or wash of the town. The population of Ashburton does not exceed 2,500 inhabitants. The land not irrigated lets for 20*s.* per acre."

The town of Malvern, Worcestershire, is most amply supplied with water, and the sewage has been applied to the grass and other lands on the Court and other farms, with the following results. Mr. Lawrence says:—

"Since we have had the sewage on this field we have had five times the quantity of hay we ever had before. We used to mow our clover three weeks before we mowed our hay. Since we have had the sewage we have mowed our hay three weeks before we cut our clover, and the grass ought to have been cut much earlier than it was; it was rotten at the bottom for want of being cut earlier. We now cut our grass for hay three times in the year instead of once, and have a good pasture for our cattle until very late in the winter."

Mr. Morrison, farmer at Malvern, states:—

"Since I have had the sewage on my farm, I get five times the quantity of hay I ever had before. I cut my first crop of grass on the 1st of May; the second crop is ready to cut again, before my neighbours cut their first and only crop of grass for hay."

The sewage and wash of the town of Mansfield has been applied to irrigate the fields in the neighbourhood of the town: previous to the application of the sewage the land let at 3*s.* *per acre per annum, the same land now lets at* £12 *per acre per annum:* value £11 17*s.* per acre per annum in favour of the sewage.

The next is the land irrigated with the sewage of Edinburgh; the 400 acres of land so irrigated lets at from £18 to £21 per Scotch acre. It has been said, if the land to which the sewage has been applied in that locality has proved so beneficial, why not apply it to the neighbouring lands? The reply is, the fortunate owner of the estate has the monopoly of the sewage of Edinburgh, and he applies the whole of it to the 400 acres, and consequently monopolises the supply of grass to the town.

The Royal Commissioners on the Sewage describe the works at Edinburgh as follows:—

"The Edinburgh Meadows afford the largest instance in Great Britain of the application of sewage by gravitation. The operation has been carried on over some of these Meadows for more than sixty years. They comprise in all about 325 imperial acres, and receive the sewage of about one-half the City of Edinburgh—that is, of something like 80,000 people.

"The crops, almost entirely of grass, are of the richest description, as may be judged from the fact that they are sold by auction every year at an average of from £20 to £30 per imperial acre.

"Of the value of the sewage application in this case no doubt can be raised. The works were undertaken in the first instance solely with the view to profit; and they have answered so well that the Meadows, some portions of which were formerly barren sea sand, are now a very valuable property.

"Another point deserves notice in regard to these Meadows. It is sometimes urged that, although it may be economically practicable to apply sewage to land where it can be done by simple gravitation, it is another matter where the circumstances are such as to require the use of steam power.

"Of the Craigentinny Meadows, some fifty acres are irrigated with sewage which is pumped up by a steam engine; and although the profit derived from this portion is less than where no pumping expense is entailed, the proprietor expresses no kind of regret at the results of the outlay and working expenses which have been incurred."

The sewage of the town of Watford is applied to the estate of the Right Honourable the Earl of Essex, at Cashiobury Park.

The noble Earl speaks as follows of its manurial value on his grass lands:—

"During the winter, from October to January, or longer, I apply it to meadows for hay, two dressings per acre, with about 50,000 gallons, *i.e.* 225 tons. I have done this now two winters, and the increase of hay, both in quantity and quality, is most extraordinary. It seems especially to thicken the bottom wonderfully, bringing up abundance of clover. I think my produce of cut grass this year, when the cuttings are over and accounts made up, will not be less than 16 tons per acre. The year before last I kept 34 bullocks all the summer, with as much as they could eat, from seven acres. They had some cake also, and were well fattened. This year I have fourteen bullocks and eight horses consuming it. The former are fattening beautifully without any other food."

The produce of grass from lands unirrigated with the sewage does not exceed 10 tons of grass per acre per annum, therefore, at 20*s.* per ton, £36 per acre in favour of sewage irrigation per annum.

Of the manurial qualities of the sewage for Italian rye-grass, the noble Earl speaks as follows:—

"I put on my Italian rye-grass about 60,000 gallons, *i.e.* 270 tons per acre, after each cutting. I am now entering on my fifth cutting. No other manure has been applied, except 1½ cwt. of guano, washed in after four enormous cuttings, each about 10 to 11 tons per acre, from sewage only."

James Caird, Esq., M.P., "Times" Commissioner, in his "English Agriculture," page 285, states:—

"On the farm of Mr. Stanfield, M.P., one field is manured by sewage from a populous neighbourhood. The produce (Italian rye-grass) of this field is always cut and carried into the stables for consumption. Each year it is cut *six times*, and after each cutting it is dressed with liquid manure."

On our average farmed lands, the produce of Italian rye-grass does not exceed from eight to nine tons per acre: here we have about 50 tons per acre, at 20*s.* per ton: £40 per acre in favour of sewage irrigation. Such is the commercial and manurial value of the sewage for the production of Italian rye and other grasses.

On the manurial value of town sewage for the production of Wheat, Baron Liebig, (in a letter dated 8th January, 1860) states as follows:—

"The contents of the reservoirs of the fortress of Rastadt, in the Grand Duchy of Baden, which received the deposits of a garrison of 8,000 men, were sold in 1858 for 8,155 florins, £815 10*s.* English money. The Commune of Oligheim, near Rastadt, consumed the greater proportion of this sewage; and, in course of a few years, they converted the most sandy, unproductive soil, into flourishing corn-fields."

I must revert again to the experience of the Earl of Essex with the Watford sewage: the noble Earl states: —

"Last year, having heard it stated that sewage was not good for Wheat, I marked out two adjoining acres in the centre of a field. No. 1 received 60,000 gallons=270 tons. No. 2 received nothing.

	£	s.	d.
No. 1 produced 53 bushels, worth at 6*s.*	15	18	0
And straw, 5 loads, at 30*s.*	7	10	0
	23	8	0
No. 2, 44 at 6*s.*	13	4	0
Straw, 4¾ loads	7	2	6
	20	6	6
Value of produce per acre in favour of sewage with one dressing ..	£3	1	6

I may here state the yield per acre on average farmed lands in England does not exceed 32 bushels of wheat per acre. But that of the noble Earl, from its high state of fertility, the land No. 2, produced 44 bushels per acre. Any one would think to put sewage on land in

such a high state of cultivation would have been like sending coals to Newcastle. But, even on this highly farmed land, the sewage increased the produce of the soil upwards of 20 per cent. with one dressing of 270 tons to the acre.

From these interesting experiments we can well understand, by having the sewage at command, our poorest lands (which are only poor for want of manure and drainage) can be made to produce on an average 50 bushels of wheat instead of 32 bushels per acre, or an increase of more than 50 per cent. from our wheat lands without fear of exhausting the soil.

I now come to the noble Earl's experience with the sewage for Mangold Wurzel, which is as follows: —

"In 1857, I had nearly seven acres of wurzel almost entirely taken by the fly, and during intensely hot and dry weather I transplanted five acres with the assistance of the sewage, and, although a transplanted crop, it was the largest I ever had — over 43 tons per acre."

The yield of Mangold Wurzel on the average farmed lands does not exceed 20 tons per acre; at 6*s.* per ton, consumers' price, worth £6 per acre. The land irrigated with the sewage produced 43 tons per acre; at 6*s.*, worth £12 18*s.*, or £6 18 per acre in favour of sewage manure, or more than 100 per cent.

Such is the manurial value of the sewage of our towns, in every instance where it has been applied to the land at proper time and in a proper manner, and in all cases the effect of the sewage on the crops has been seen within the first six months after its application. I have shown the manurial value of sewage on Grass, Italian Rye Grass, Wheat, and Mangold Wurzel.— I will now take one acre each and compare the produce with the same area on non-sewage manured land.

RETURNS FROM FOUR ACRES SEWAGE MANURED LAND.

	£	*s.*	*d.*	
To 1 acre of Wheat 53 bushels @ 6*s.*	15	18	0	
,, 5 loads of Wheat Straw per load @ 30*s.*	7	10	0	
,, 1 acre of Mangold Wurzel, 43 tons, @ 6*s.*	12	18	0	
,, 1 ditto of Grass 46 tons, @ 20*s.*	46	0	0	
,, 1 ditto of Italian Rye Grass, 50 tons, @ 20*s.*	50	0	0	
Total value of produce for four acres				£132 6 0
Average value per acre, £33 1*s.* 6*d.*				

RETURNS FROM FOUR ACRES OF AVERAGE FARMED NON-SEWAGE MANURED LAND.

	£	*s.*	*d.*	
To 1 acre of Wheat, 32 bushels @ 6*s.*	9	12	0	
,, 4 loads of Wheat Straw, per load, 30*s.*	6	0	0	
,, 1 acre of Mangold Wurzel, 20 tons @ 6*s.*	6	0	0	
,, 1 acre of Italian Rye Grass, 10 tons @ 20*s.*	10	0	0	
,, 1 acre of Grass, 10 tons @ 20*s.*	10	0	0	
Total value of produce for four acres				£41 12 0
Average value per acre, £10 8*s.*				
Balance in favour of sewage manured lands				£90 14 0
The agricultural produce from sewage manured land is	£33	1	6	per acre.
The same from non-sewage manured land	10	8	0	
Increased produce per annum	£22	13	6	per acre.

The cost of cultivation to be deducted in both instances. But all farmers will admit that land in a high state of fertility, and with plenty of manure at command, is tilled at a much cheaper rate than land in a poor state.

Now if we take the sewage of London and the washings of the streets, as it goes into the Thames, at 400,000,000 tons annually, and with the experience of the Earl of Essex, Mr. Mechi, and others, for our guidance, at the rate of 270 tons per acre, the London sewage would manure 1,481,481 acres per annum, and yield an additional quantity of agricultural produce at £20 per acre, worth £29,629,620 per annum, *i. e.* supposing the sewage only to be applied to the above area. But it is well known that after a good manuring the land will produce several crops of grain before it requires manuring again; consequently the sewage may be extended to from two to three times the above area.

And as the Earl of Essex justly observes —

"In dry springs, a barley or oat crop may be well saved by having sewage at command.

"I have myself made experiments on turnip seed with town sewage with the most satisfactory results. As soon as the seed was sown, the land was irrigated with sewage, the seed immediately germinated into strong healthy plants, and were out of danger from the turnip fly, before the seed not irrigated made its appearance above the ground."

With reference to the fattening properties of sewage manured grasses, Mr. Way's recent analysis has revealed the astounding truth, "that grasses irrigated with sewage contain 100 per cent. more meat-making matter than grasses not irrigated."

On this subject the Earl of Essex states: —

"Doubts have been raised as to the fattening properties of sewaged Italian rye-grass. I have had thirteen bullocks, 2¼ years old, feeding entirely and solely on cut rye-grass in the yard all the summer, never having had an ounce of cake or corn since they were born, and have sold some of them for nearly £20 a-piece. Better or fatter beasts, full of inside fat, could not be wished for, which is proved by the eagerness of the butchers to have six which I have left."

I put the following question to Mr. Mechi — "If you had a constant supply of town sewage on your farm at 30*s.* per acre per annum, should you require to purchase oil-cake?" *Reply* (see Mr. Mechi's "Agricultural Catechism"), "I should save 30*s. per acre* in the purchase of oil-cake and other food alone, after paying for the sewage."

Astounding as these statements seem, they are nevertheless "stern facts;" and, if we take the whole of the sewage of England, as it runs into and pollutes our fair streams, at 4,000,000,000 tons per annum — if this vast mass of manure were applied to fertilise our fields, would it not give us something like 20,000,000 additional quarters of grain per annum, besides an abundance of agricultural produce of every kind, and enable us to dispense with importing grain and foreign guano, at a cost to the nation of something like £30,000,000 per annum? If we were wise, could we not export grain and cattle, and other agricultural productions, after feeding our home population? Besides

"To our towns this is a question of health,
To our landed interests a question of wealth,
And the well-being of the whole community."

The next question is the rate at which our landed proprietors can have this wealth at their disposal — "*Why, at about* £2 10*s. per acre*, and a constant supply of manure in every field on their estates always ready at a moment's notice!" to flow over the land by gravitation, without the aid of steam engines, pumps, or machinery of any kind.

The sewage can be supplied to the farm, *ad libitum*, at the rate of 30*s.* per acre per annum, at which rate it will pay the capitalist 20 per cent. per annum on the outlay for constructing the necessary works, and supply our farmers with this invaluable manure.

As to the sanitary part of the question — those using the sewage speak as follows: —

Mr. Lawrence, Court Farm, Malvern, says: —

"I have never heard any one complain of the sewage. *It is not a mile from the farm into the town.* You see my house is within a couple of stones' throw from us. I do not smell anything; but I shall be glad when we get it into the next field, which is before my door; we shall have the sewage on there in the spring. No, there is very little or no smell, the soil soon deodorizes it."

I asked Mr. Morrison, farmer at Malvern, if there was any complaint about the smell? The reply was —

"No; I am anxious to get the sewage across the valley into the field before my house-door: it would improve that field very much. No, there is no more smell than there is now; and you see the field is now under the process of irrigation with the sewage as it comes out of the sewer. I have no complaints from any one."

The Earl of Essex states: —

"As to the sanitary part of the question, I can only say that neither of my men who live at the work, the engine and tanks, or the two men who handle the hoses, and who smell the sewage more or less all day, have ever once complained of any bad effects whatever.

"Some people have grumbled at the smell of the sewage, but I think they are getting tired of doing so, as I took no notice of it. I believe their complaints were most frivolous, and that, although the smell for a few moments may be unpleasant to very sensitive noses, it is quite innocuous. The men who manage the hoses have never, from first to last, found themselves incommoded in any way."

The plan I have the honour to propose for supplying the sewage of our towns to fertilise our fields, has received the approbation of all parties who have paid the least attention to this subject — *including my late lamented friend, Mr. Robert Stephenson, Baron Liebig, and others* — both for efficiency and economy. I most respectfully invite the landed interests to lend a helping hand to put this great scheme into operation, and a very short period will produce permanent results in our fields, in the shape of rich and abundant crops, both for man and beast; and, as *The Times* on the 23rd of December, 1859, justly states, "The very substance which is pollution to you in one place, will be salvation to you in another. The sewage of your towns well bestowed will relieve you from all anxiety, and preserve the fertility of your soil and the strength of your population from impoverishment and decay." (Loud cheers.) *We shall thus gather up the fragments, and nothing will be lost.*

EXTRACTS AND CORRESPONDENCE.

The following letters have been received from Baron von Liebig.

Munich, 2nd January, 1860.

Dear Sir,

I have read your pamphlet with great pleasure. It has given me the conviction, that your plan for the recovering of the manure element out of the sewers of London is perfectly practicable, and that the difficulties I supposed stood in its way, are much easier to surmount than I thought. It is a most fortunate event, that men like Mr. Mechi and yourself are determined to devote their energies to that true cause of humanity. I am sure you will succeed.

Believe me, dear Sir,

Yours truly,

JUSTUS VON LIEBIG,

President of the Royal Academy of Science, and Conservator-General of the Royal Collections, and Professor of Chemistry.

Geo. Shepherd, Esq., C.E.

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29 *Austin Friars, January* 6, 1860.

Dear Baron Liebig,

Your "Chemistry of Agriculture," page 165, contains the following paragraph:—"The domestic arrangements peculiar to the English render it difficult (perhaps impossible) to collect the immense quantity of phosphates which are daily sent into the rivers, in the forms of urine and excrement."

This statement, coming from so eminent an authority, has induced most people to consider it almost impossible to do anything with the London sewage, otherwise than throw it into the Thames.

As my plan for utilising the sewage of London has received the approbation of all parties who have paid the least attention to this subject, will you be so kind as to favour me with your opinion?

I am, dear Baron,

Yours very truly,

GEORGE SHEPHERD, C.E.

Munich, January 9, 1860.

DEAR SIR,

My ideas about the possibility of collecting the sewage of London have undergone a considerable change by the perusal of your pamphlet on "London Sewage, and its Application to Agriculture." The simple way in which you solve the problem has convinced me, not only of the possibility, but of the practicability of collecting the sewage of London for agricultural purposes.

If in Cornwall (as you show by statistics), 22 steam-engines—total, 1,140 horse power, with a consumption of 1,413 tons of coal—have raised 11,000,000 tons of water 20 yards high in one month, it is easy to perceive the correctness of your calculations. Supposing the London sewage to be 70,000,000 of tons, annually required to be raised 350 feet high, it could be done by steam-engine power representing 3,200 horses—or about the steam power of four of your large steam ships. This settles the whole question.

I am, dear Sir,
Yours very truly,

JUSTUS VON LIEBIG.

GEO. SHEPHERD, ESQ., C.E.,

"In addition to the sewage of London, the wash from our streets during the first half-hour of a smart shower of rain is most valuable; it contains the droppings from the thousands of horses and cattle which daily traverse the streets, the carbonaceous deposits from the tops of the houses, the washings of our market places, fish stalls, &c., &c.—a manurial treasure, organic and inorganic. 'All this goes into the Thames.'"

Mr. GEORGE SHEPHERD, *on the London Sewage for Agricultural Purposes.*

"The streets of our towns are the horses' water-closets."—Mr. CHADWICK.

"As a general rule (except on particular soils) our parks are poor, mossy, and unsatisfying to deer and other animals. Sewage would alter all this—bringing sweet and abundant herbage, promoting and prolonging the growth of our noble timber trees. If you doubt it, examine Lord Essex's park at Watford, where the mere application of sewage has destroyed the drab and coarse ferns, and substituted for them rich, green, soft herbage. The line of demarcation, where the sewage has not reached, is strikingly illustrative of its great merits. There are many extensive wastes and commons lying within reach of our large towns and cities, which would, by the mere application of sewage, become covered with a rich and spontaneous vegetation, acceptable and fattening to animals."—Mr. MECHI, *on the Sewage of our Towns.*

"In the year 1855-56 above 10,000,000 cwts. of guano were imported, of which the greater portion remained in England. In the course of half-a-century above 60,000,000 cwts. of bones have been imported into that country, yet all this mass of manure is not worth mentioning when considered in relation to the arable surface of Great Britain, and is but as a drop when compared to the sea of human excrement carried by the rivers to the ocean."

BARON LIEBIG (*Modern Agriculture*, p. 222.)

"Our fields are like a well of water. For centuries those elements which are indispensable to the reproduction of the crops have been taken from the soil in those crops, and that, too, without being restored. It has only recently been ascertained how small a supply of these elements the soil really has. A beginning has been made to restore to the fields the losses which they sustained through the annual harvests, by introducing from external sources manures containing the same elements. Only a very few of the better informed farmers perceive the necessity of this restoration, and those of them who have the means have zealously endeavoured to increase the amount of these elements in their fields; but by far the greater part of them know nothing of such restoration. They think that they may continue to take from the field as long as there is anything left, and that it will be time enough to provide for this necessity when it knocks at their doors. They do not, of course, know how large their stock on hand is, nor are they aware that when the necessity shows itself there will be no means to correct it; they know not that what they have wasted is irretrievable. The loss of these elements is brought about by the 'sewerage system of towns.' Of all the elements of the field which, in their products, in the shape of corn and meat, are carried into the cities, and there consumed, nothing, or as good as nothing, returns to the fields. It is clear that if these elements were collected without loss, and every year restored to the fields, these would then retain the power to furnish every year to the cities the same quantity of corn and meat; and it is equally clear that if the fields do not receive back these elements agriculture must gradually cease. In regard to the utility of the avails of the 'sewerage of towns' as manures, no farmer, and scarcely an intelligent man, has any doubt, but as to their necessity opinions are very various. Every farmer who takes a sack of corn, or a cwt. of rape, turnips, potatoes, &c., to the town, ought, like the Chinese coolie, to carry back with him from the town an equal (or, if possible, a larger) quantity of the mineral constituents of the produce sold, and restore them to the field from which they have been taken. He should not despise the peel of a potato, nor a straw, but always bear in mind that that peel may be wanting to form one of his potatoes; that straw to form one of his ears of corn."*

BARON LIEBIG (*in a Letter to the* TIMES, *23d December*, 1859.)

* My father took a farm in Shropshire, the soil of which was literally exhausted: to use a familiar expression, it would not give back a *new seed* for an *old one*. At the age of 14 years a small garden was allotted to my care; when deprived of the farmyard manure, I had recourse to the "*House Sewage*," and my garden produced most abundant crops. I may add the farm was brought in a few years to a high state of cultivation by the simple process recommended by Baron Liebig, namely, by collecting all the refuse, house sewage, road scrapings, &c., from the neighbourhood. But the "ILLIBERAL TERMS ON WHICH FARMS ARE LET," *and the* OFFICIOUSNESS OF A BATCH OF "LAND AGENTS," are the chief obstacles to agricultural progress in England.

THE AUTHOR.

A short time ago, during the French invasion discussion, Lord Overstone wrote on this subject as follows:—"It cannot be, that an enemy should be permitted to land in England," and then proceeded to describe the consequences which must inevitably ensue from such a calamity. My Lord, we have an enemy among us more terrible than that of an invading army, and before which the strongest arm is powerless, and the strongest mind quails,—that enemy is FAMINE. Our working classes, with their large families, England's future strength, find with all their hard labours they cannot make the two ends meet out of their week's wages: they have to pay 6*s.* per week for rent, 10*d.* per lb. for their bit of animal food, 9*d.* for their loaf of bread: all their wages go for food, and even then the cupboard is often bare, while their wives and children are in rags. With such a state of things can we wonder if a spirit of discontent creeps over them, and they become tools in the hands of such men as Mr. Potter?

The writer has had the honour of a long experience with the working classes of England. With plenty of work, and food at a cheap rate, no class of men are more contented, or more industrious in their workshops, or show a greater degree of patriotism, whether by land or sea, when their country is in danger: when they enjoy that inestimable blessing of plenty, we hear nothing of strikes or discontent, the agitator is at a discount, and the vast machine of England, commerce, rolls on in admirable order.

At present, however, we are not only in the midst of a famine for bread, but we are equally destitute of animal food, and all the misery it entails. Who is to blame for all this? "The truth must be told." The landed proprietors of England are the parties on whom this responsibility must rest, and until they have raised their agriculture to the perfection of our manufactures, they will continue to be responsible for the scarcity of food the English nation suffers. We can read in this discovery the unerring laws of nature, and know these years of great scarcity will roll on us again with terrible rapidity: we also observe the array of cold winters and late cold springs, which will keep back vegetation, and deprive the farmers of pasturage for their stocks, and the nation of animal food, while, on the other hand, we have an increasing population to provide for when these calamities come upon us, which will make each year of scarcity all the more perplexing. During the winter of 1860-1, when on the verge of food riots, we had recourse to public charity, and thousands of pounds were subscribed for the purpose of bridging over the difficulty. But "*national charity*" must fail if "*national duties are neglected.*" So long as we rob the soil of its fertilising powers, we rob the nation of its food, and undermine its wealth and prosperity.

I look on manure and the soil as *man and wife, the produce their progeny:* take away the head of the family, the manure, and we see the result in the poor, stunted, vegetation on millions of acres of land throughout the country.

In travelling through the country the effects of the cold winter of 1860 and spring of 1861 are too apparent in all directions: on the poor lands the young wheat plants in numberless fields have perished, not on account of the cold, but in consequence of the *poverty of the soil;* while on well-manured land the young plants have passed through the winter without sustaining the slightest injury. If we deprive a man of food, all the clothing we could load him with would not keep him warm; but give him plenty of food, and the cold is comparatively little felt. The same with the soil: deprive it of its fertilising powers, and it becomes cold, feeble, and powerless to support vegetation. On the other hand, give it plenty of manure, and vegetation will even thrive during the coldest weather. Improved agricultural implements are all very well in their way, but the most perfect machinery human ingenuity could devise would be powerless if the owner of it lacked fuel to get up the steam to put it in motion, and "raw materials" out of which to manufacture goods for the market. The most formidable artillery is powerless without ammunition: even so is a soil deprived of manure.

Let us now examine the bright side of this question. We see from the facts already adduced, whenever the sewage has been applied, we have not one instance of its failure, but everywhere it has produced the most astounding results: even from the most sterile of soil, with its aid,

Grass land produces	- - -	46 tons of grass per acre.
Rye grass „	- - -	50 „ „
Arable land „	- - -	53 bushels of wheat per acre.
Mangel Wurzels and Turnips	-	43 tons „

At Ashburton it has raised the rental value of land from £1 to £6; the Links Farm at Malvern, with only twenty acres irrigated, from 35*s.* 6*d.* to 82*s.* 10*d.* per acre; at Mansfield from 2*s.* 6*d.* to £12; at Edinburgh it has raised the value of land from a few shillings to £35 per acre. In Germany, Baron Liebig writes it has converted a most sterile soil into fruitful cornfields. (See statement of the author in his speech at the Society of Arts.) On the lowest calculation we throw away about 3,000,000,000 tons of this valuable manure annually, which if applied at the rate of 300 tons to the acre, would irrigate 30,000,000 acres of land per annum. With its aid each acre of grass land becomes equivalent to five, and each acre of arable land equivalent to three acres of the present farmed land. With these

facts before us, if the sewage of our towns was judiciously applied to the soil, it is impossible to estimate the vast mass of wealth it would place at the disposal of the nation, or the increased wealth which would flow into the pockets of the landed proprietors.*

We have no scruple about eating the excreta-grown corn and sewage-fed cattle from Belgium, or drinking the excrement-manured teas from China. Whether the excreta of a Belgian or a Chinese are sweeter than that of a well-fed Englishman, I do not know: perhaps Dr. Shorthouse could solve this problem.†

With these vast resources at home, is it not humiliating to England in this so-called enlightened age, to read the following weekly official statement?—

"Metropolitan Cattle Market, *September* 24, 1860.

"The arrival of cattle and sheep into the port of London from the Continent has been large: the official Custom-House return gives an entry of 2,470 oxen, 406 calves, 12,774 sheep, 1330 pigs, and 15 horses, making together a total of 16,995 head, against 20,050 head at the corresponding period of last year."

With the still further fact, that a large number of the cattle sent into the London market are imported chiefly from Belgium, *which, if we are to credit the official census of that country, not only supports a population of nearly forty individuals more to the square mile than in England*, but exports a large quantity of live stock and grain annually to the London market. In Belgium, the farmers hold human excreta and urine in high estimation as manure; while the English farmer throws it into the nearest ditch to his dwelling, and like a dirty bird befouls his own nest.

Look again at the state of things in 1861: we had a late cold spring, the farmers dreadfully short of pasturage for their stocks, animal food for the population at famine price. On the other hand, if any of my readers would visit the Court or Links Farm at Malvern, the irrigated meadows at Ashburton, Watford, or Edinburgh, or other of the sewaged land, they would then find not only the pasturage most abundant, but in most instances the farmers cutting grass for their cattle; and the same in the spring of 1860. The sewage is our only hope, and the only protector of England's wealth.

* In describing these facts one feels something like the late eminent engineer, George Stephenson, when he was told he must only let his locomotive engine run 14 or 15 miles per hour, if he hoped for any to take notice of him or get his Bills for railways passed through the legislature —almost afraid to tell the truth for fear of offending some so-called sanitary engineer, *eminent* M. D., or crotchety reviewer.

† A somewhat lively friend of mine remarked, if he was compelled to eat dirt, he should rather consume his own dirt than that of any other person.

THE MANURIAL VALUE OF SEWAGE FOR GRASS LAND IN COLD SEASONS.

I BEG now to call attention to the following extracts from correspondence with farmers using the sewage manure, which will show the state of their pastures during the late cold winter of 1860, and spring of '61, which proved so disastrous to farming stock in almost every part of the kingdom: from their experience the use of sewage manure would prevent the recurrence of such disasters, and avert the calamitous effects of the present almost famine price of agricultural produce to the nation.

Extract from the letter of Mr. N. MORRISON, *Bedford House, Malvern.*

"*2nd May*, 1860.

"DEAR SIR,

"In answer to your letter of the 26th ult., I have to inform you I have left the Links Farm. * * * * I was then paying for the 90 acres of land, £160. At the time I took it I could scarcely raise a new seed for an old one. I left the farm in consequence of my landlord giving me notice to quit, with the view of raising my rent. Upon my own improvements, the farm now lets for £373 per annum.† Only 20 acres out of the 90 are irrigated. My opinion, after six years' experience, is, that irrigation with sewage is the finest thing possible for grass land; the quantity of stock it enables you to keep is surprising. The bite is much earlier, and continues much later than on the non-sewage lands.

"The present tenant is Mr. Adams. He may be able to give you the information you require."

Extract from Mr. ADAMS'S *letter — the present Occupier of the Links Farm, Malvern.*

"*7th May*, 1860.

"DEAR SIR,

"In reply to yours of the 3rd inst., I am well off for grass upon the lands upon which the sewage has been running; indeed, my grass looks very green, and should the weather take up, and we get some warm, genial rain towards the end of this month (May) I shall

† An increase in the rental from 35*s.* 6*d.* to £4. 2*s.* 10*d.* per acre.

commence hay-making; in fact, I am now mowing grass for thirteen cows, besides horses, and have been for nearly a fortnight. Since I took this place I have carried the sewage over ten acres more land than was before irrigated, and feel confident the cattle generally do better from either the grass in a green state or in hay, than from any grown under different circumstances. I am sure, if farmers generally considered their own interests, they would not allow one particle of water, even from their farm-yards, to run to waste. I am running the sewage now over the grass after cutting, and you would be astonished to see the rapid growth it makes.

"I am, yours very truly,

"Geo. Shepherd, Esq., C.E." "J. V. ADAMS.

Extract from the letter of G. M. CANN, Esq., *Court Farm, Malvern.*

"*5th May*, 1860.

"DEAR SIR,

"I am glad to say that my two meadows manured with town sewage are full of keep, although I now have, and for the last *three weeks* have had, 200 sheep and more than 30 head of cattle in them. The grass is fast growing upon them. I have no hesitation in saying that, where town sewage can be carried over land, there is no manure equal to it. I find that, where it has been turned off only a few hours, cows, horses, and sheep will graze most eagerly. I have, this winter, kept 50 horses, and more than 300 sheep, yet I am thankful to say that I have now by me (*owing to the sewage*) between 60 and 70 tons of hay, of first-rate quality, which I am selling in this place at 6 guineas per ton. My meadows are, as you may remember, very uneven on the surface, and, therefore, I keep a man constantly employed in attending to the irrigation, and say for six or eight months, at a cost of about 8*s*. per acre — a small sum for an extra ton of hay, and full 50 per cent. more grass, per acre. My neighbour, Mr. Adams, Links Farm [see Mr. Adams's letter], has mown grass for his milking cows for nearly a fortnight, and is regularly doing so. He is as fully convinced as yourself of the efficacy of the sewage, wherever it can be got, and is more sanguine than myself (if possible) as to the result of its effects. * *

"I am, yours very truly,

"Geo. Shepherd, Esq." "GEORGE M. CANN.

It has been stated that the sewage is only applicable to light lands. Both farms at Malvern are heavy clay soil, and but very indifferently drained, yet the pastures for the cattle have been most abundant under the most trying circumstances.

Extract from the letter of the Right Hon. the Earl of Essex, *in reference to the Watford Sewage.*

"Cashiobury Park, *May* 2, 1860.

"Sir,

"In reply to yours of the 26th ult., I beg to say that about the 1st April, I began feeding off three acres Italian rye grass, which was sowed on wheat last summer, and were watered with sewage in the autumn and early part of this year. When that was fed off, my ewes and lambs went to ten acres sowed with barley last year, and also well watered. The two fields gave my ewes and lambs nearly a month of good feed, and I really know not what I should have done without it. The first piece is now ready to feed off again. I have seven acres of rye grass of last year, which is looking wonderfully well, and I shall begin cutting it for bullocks in my yard in a week or less. Had the weather not been so cold, I should certainly have been able to cut it a week or ten days ago.

"Yours obediently,

"Geo. Shepherd, Esq." "ESSEX.

Well may Lord Palmerston remark:—

"If the sewage be judiciously applied to the land, I am fully persuaded that not only would the health of the town population be greatly improved, but the finances of the agricultural population would derive considerable benefit from the change."

And Baron Liebig, in his Modern Agriculture, speaking of the Romans, who also had their sewers and wasted their human excrements, says—(pp. 241—242)

"All these rules had, as history tells us, only a temporary effect; they hastened the decay of Roman agriculture, and the small farmer ultimately found that he had exhausted all his expedients to keep his fields fruitful, &c., and, as the history of the three first centuries of our era informs us, there ensued a condition of the population the most calamitous and frightful into which a nation can fall. It is true that many causes co-operated in producing this result, but assuredly one of these was the exhaustion of the soil by the spoliation system of agriculture then pursued."

He says of the Chinese (p. 243):—

"I will show the teachers of agriculture another nation, who without the aid of science have found the philosopher's stone which those very teachers in their blindness vainly seek. I will point out to them a land the fertility of which has for 3,000 years never decreased, but, on the contrary, has been ever on the increase, and where more men are crowded together on a square mile than are to be found on the same space in Holland or England. . . . It is quite impossible for us in Europe to form an adequate conception of the great care which is bestowed in China upon the collection of human excrements. In the eyes of the Chinese these constitute the true sustenance of the soil (so Davis, Fortune, Hedde, and others tell us), and it is principally to this most energetic agent that they ascribe the activity and fertility of

the earth. . . . The estimation in which it is held is so great that everybody knows the amount of excrements voided per man in a day, month, or year, and a Chinese would regard as a gross breach of manners the departure from his house of a guest who neglects to let him have that advantage to which he deems himself justly entitled in return for his hospitality. . . . . Except the trade in grain and in articles of food generally, there is none so extensively carried on in China as that of human excrements. Every system of farming based on the spoliation of the land leads to poverty."

Again :—

"The deplorable effects of the spoliation system of farming is nowhere more strikingly evident than in America, where the early colonists in Canada, in the States of New York, in Pennsylvania, Virginia, Maryland, &c., found tracts of land which for many years, by simply ploughing and sowing, yielded a succession of abundant wheat and tobacco harvests, no falling off in the weight or quality of the crops reminded the farmer of the necessity of restoring to the land the constituents of the soil carried away in the produce. We all know what has become of these fields. In less than two generations, though originally so teeming with fertility, they were turned into deserts, and in many districts brought to a state of such absolute exhaustion, that even now, after having lain fallow more than 100 years, they will not yield a remunerative crop of a cereal plant."

It will be observed in the remarks from *The Times* (see page 63) on this subject, "No more bones are to be procured from Germany, and that guano cannot last above twenty-five years at the outside."

Now just for a moment suppose a statement to be made to our ironmasters, or any other class of our manufacturers, that the supply of their raw materials would be exhausted in twenty-five years, with the certainty of that supply being in the hands of monopolists, as it each year became more exhausted, higher prices would be demanded. We can imagine the consternation it would cause; but if we could tell them with the same breath, they had a perpetual supply at their own doors of a superior quality, at one-tenth the cost they were paying for the materials then in use, and all they required was a little alteration in the present machinery to bring that article into immediate use, would not each one try to rival his neighbour to be first in the market from this new source?

Again, suppose our ironmasters were importing their iron ores from Peru, and a valuable inexhaustible vein of superior ore was found on an estate adjoining their works, and could be delivered at one-tenth the price of the Peru ores, *should we not say they were mad not to use it?* Most certainly we should: this is just the position of the agriculturists in England at the present moment. Within a mile — nay at the very outskirts of our towns — we find farms of the most poverty-

stricken character, and the farmer purchasing manure imported 16,000 miles, while the town, the great manufactory of manure, is close at his very door; nay the stream of manure in many instances running through his sterile fields. It is impossible to conceive such a state of things — but so it is.

Again, suppose a great scarcity of iron ore prevailed in Staffordshire and Wales, the works were stopped, and general distress ensued in those districts, while the little state of Belgium was manufacturing and exporting iron into the English market out of the refuse the English manufacturers threw away — would not some Honourable or Right Honourable Gentleman rise in his place in Parliament and tell the manufacturers they were responsible to the nation for that distress, and bid them go to Belgium and learn wisdom? Then reversing this question, Belgium supplies not only her own dense population, but also exports food and cattle to the English market, produced from the refuse — excreta and urine — the English landowner throws away, while distress and famine reign in every part of the kingdom. By the same rule, then the landed proprietors must be responsible to the nation for this state of things.

Show a manufacturer how to save 6 or 7 per cent. in the production of his goods, you give him a tremendous advantage over his rivals in the market. But to the landed interests we offer no such small considerations. If the sewage is applied to fertilise our fields, it will increase the produce of the soil from 200 to 300 per cent. per annum, and enable our farmers to supply grain and cattle for our markets at a rate no foreigner can compete with.

The late Sir R. Peel in a letter to J. Caird, Esq., dated 6th February 1850, after deploring the present state of our agriculture, wrote:—

"Nothing has hitherto been effectual in awakening the landed proprietors to a sense of their own interests."

But if the starvation, distress and ruin, which prevail in every direction at the present moment, and their own interest, do not bring them to a sense of their duty, they must be dead indeed to their country's interest and welfare. Be assured England has no other resource but that of returning to the soil the riches she receives from it, nor do we need any other help if the population were double the present amount.

To the landed proprietors, then, we would say, my lords and gentlemen, your exhausted soil is the only vulnerable place in England's breastplate: you hold the keys of England's future in your hands: you must not expect the mercantile community to devote their time and attention to improve your position. You

understand agricultural questions best, and the country looks to you and to you alone. Only put yourselves at the head of the movement: you can now see from the Meteorological Table what is before you, and the almost certainty of another terrible disaster in 1864, similar to the one we have just experienced. A great deal may be done in this time; your present 20*s.* per acre land will be then worth its 3*l.* and 4*l.*, per acre; the country will support you with the means, and the intelligent workmen will do the labour.

The banker looks to you to protect his gold; the merchant and the manufacturers with their vast establishments, the pride of England, ask you to bring the land up to their standard of perfection; the workmen of all classes ask you to do your duty, and give them and their children bread to eat. The disasters of 1860–1, described in the first pages of this work, cannot be repeated many times, without bringing you down too. *The Times* on the 22nd December, 1860, gives you the following solemn warning: —

"It is to the labourer on whom we must depend after all for the cultivation of our fields, and the maintaining of our army and navy, and all the other operations of this vast machine. When once he breaks down or shows the dry rot, or ceases to care for his country, it is all up with us."

With a deficient harvest and scarcity of food, you will see from the following letter, addressed by the writer to Lord Calthorpe on the 9th December, 1860, how misery creeps on us and the havoc it produces.

9th December, 1860.

The Right Honorable Lord Calthorpe.

My Lord,

In addressing your Lordship, the great distress existing in almost every part of England at the present moment must be my apology for doing so, it being a subject of the deepest importance to the banking, commercial, political, and social interests of England. The present state of things most clearly proves:—

First. That the first requirement for the independence and well-being of England is food in abundance for the population.

Second. That scarcity of food or food at high prices paralyses our trade and brings distress, decay, and misery on our working classes, spreading loss and ruin in every direction.

With enhanced prices of food, we first experience a general depression of trade and commerce; *i.e.* every house and establishment reduces its expenses to a minimum—nothing is purchased that can possibly be dispensed with. This state of things recoils on the manufacturer, who, in his turn, anxious to keep his experienced hands together, his workman's time is reduced to two or three days per week. The working classes make little or no provision for the contingencies—live they must; they go on the poor-rates and in debt to their tradesmen, and during their hunger and misery are the ready dupes of every wily agitator, to promote strikes, &c., in order to obtain redress for their fancied wrongs. The sufferings of

the tradesmen fall on the manufacturer who supplies the goods, while he, with his overstocked warehouses and heavy expenses, is unable to bear the burden, and so the ball keeps rolling: his losses fall on the merchant, who from inability is prevented from meeting his engagements. Hence, his losses come with full force on the coffers of the bankers, and from the monetary part of the community confidence vanishes and sweeps before it the hard earnings of many years' patient industry. While this terrible struggle is going on at home, money is flowing out of the country to buy food, the foreigner preferring our gold to our manufactured goods, and with it builds manufactories which compete with those of this country. Therefore, commerce with its head of gold, unless well supported by agriculture, has feet of clay. I once asked an eminent manufacturer how much time he devoted to the consideration of the "raw material" from which he produced his articles. He replied, "One-half or two-thirds of my time is devoted to that alone." I put the same question to an eminent landowner, his answer was, "I consider it no business of mine. That is a question for the farmer." Here we have a very important admission, from two parties, each anxious to make the most of their properties. The former can supply manufactured goods to every part of the world, while the latter cannot produce sufficient for the population at home. If we look at the estates of our large landed proprietors in a commercial point of view, they simply represent the outer buildings of factories. The farmers, the machinery inside the factories, manure his "raw material" from which he produces his grain and stocks for the markets. Naturally, then, with a scarcity of the "raw material" the soil ceases to be productive, scarcity of food results, and then follow the consequences already described. During the late discussion on the sewage of our towns in *The Times*, an eminent farmer visiting me, remarked:—"If I had plenty of manure at a cheap rate, I could make a large profit from my farm, if wheat were only 35*s*. per quarter, and everything else at a proportionate rate; it is the want of manure that kills us." If the want of that article is disastrous to the farmer, it is a thousand-fold more so to the community at large. The additional months of cold winter in 1859, and the late cold spring of 1860, made sad havoc with the farming stocks of England, and raised the price of animal food to almost famine prices, the late wet harvest completing the tale of misery. While, should an European war unfortunately occur, how food would be obtained for our teeming population is a question for wiser heads than mine to solve. It is useless to speak of the French treaty or other causes, it is the rigid economy in every household at such times which produces universal depression. Consequently, the protection for England's wealth is abundant manure for our soil. The sewage of our towns contains all the elements of the far-fetched guano, and it having given such good account of itself in our fields, it is to this source we must look for a constant supply of this important article, and once properly applied to the soil it will fill our barns with plenty, and give us food for a rainy day.

My Lord, the experimental works at Croydon, when completed, will convince the most sceptical that this invaluable manure can be applied at a rate remunerative to the capitalist, landowner, and the farmer. All we require is, a few gentlemen subscribing, say £100 each, certainly a small sum among our wealthy landowners, bankers, and the commercial community, to develope this great national experiment, which without doubt will be the forerunner to a general system of utilising our sewage — a boon to the country at large, and a safeguard to England's wealth and position.

I have the honour to be your Lordship's

Most obedient Servant,

GEO. SHEPHERD, C.E.

FROM "THE TIMES," DECEMBER 23, 1859.

The philosopher who asserted that dirt was only a good thing in the wrong place could have had no conception of the magnitude of the truth to which he gave so sententious an expression. The maxim has now acquired a scope perfectly incredible. The mere displacement of a particular substance is said to threaten us at this very moment with some of the most terrible calamities that can befall a State. Our sewage is in the wrong place, and because it is there, and not in the right place, we are incurring enormous risks. Sanitary authorities assure us, that unless we remove this matter from our towns and dwelling-places life will be abridged, and society ultimately disorganised. Agricultural authorities impress upon us, with equal earnestness, that unless we forthwith transfer this very matter to our fields, the soil will cease to be productive, and the population decay for lack of food. Town and country are thus menaced with ruin from one and the same cause, while each would be relieved by one and the same remedy. What is worse than worthless in one place would be invaluable in the other. We hardly know where to find an illustration of this extraordinary phenomenon. Perhaps the image of a father of a family choked by a nugget of gold in his throat, while his children were perishing for want of the bread which that gold would buy, may convey some notion of the state of things depicted for our warning.

One half of the case, it will be remembered, we have fairly accepted. Tardily, but, in the end, with a resolute conviction, we have determined to remove all sewage matter from our towns, and especially from this immense metropolis. That branch of the proposition, then, we may dismiss for the present. Mr. Thwaites and his colleagues have got the money and means to drain London of its refuse most effectually. We shall take this refuse from its wrong place, and it remains only to be considered whether we shall put it in its right place. Now, if anybody is doubtful as to where this place may be, we can only recommend a perusal of Baron Liebig's opinion on the subject. That opinion we publish this morning, and few people after reading it will think that we have overstated its purport. Whether its doctrines can be absolutely sustained is another matter, but there are the views of that eminent authority distinctly expressed. His theory has certainly a foundation in truth. He asserts that the elements of fertility contained in the natural soil of the earth are not inexhaustible, and that, if they are constantly abstracted and never replaced, the supply must some day fail. The earth is productive by virtue of these elements, a portion of which passes away with every crop raised from it; but as they do not reproduce themselves spontaneously, they must either be restored to the ground artificially, or, in the end, they must cease to exist, and then farewell to the fruits of the earth. Already we have had symptoms premonitory of this consummation. Our fields began to fail, and we are strengthening them with guano and bone-dust. But bonedust and guano are only ephemeral aids. They are almost exhausted already. No more bones are to be procured from Germany, and indeed, as our readers have seen, people go even to Sebastopol for a cargo. Guano cannot last above 25 years at the outside, and then what is to be done? One thing only, says Baron Liebig; and that ought to have been done years ago. We must restore to our fields what we incessantly abstract from them in the shape of corn and cattle. We must return our sewage to its right place, and then it will once more be well with us, and England may remain fruitful for generations to come.

In point of fact, our situation is such that we must needs accept it with alacrity. We have taken one of the two steps which constitute the whole proceeding, and it would be preposterous to stop half-way. Sewage matters are to be removed from our towns. The substance will be taken from its wrong place, and we shall have got it accumulated in reservoirs, or at outfalls, waiting for disposal. What is more, we can't tell how to dispose of it, or where to bestow it. We have thrown it into the Thames, and ruined our metropolitan stream. We wanted to throw it in a little lower down, but that would not do. We can hardly carry it to the sea, for it would cost too much money. It is, or will be, out of its wrong place, but where is the right place to be found? Baron Liebig and Alderman Mechi here come to our relief. Turn it into your fields they say, and you will be the great benefactors of the age. The vitality of the State depends upon it. You cannot do without it. You are, at present, protracting a dependent and precarious existence by means of South American manures and North American breadstuffs. The New World is bolstering up the Old World for a time, but this cannot go on. Now, the very substance which is pollution to you in one place, will be salvation to you in another. The sewage of towns, well bestowed, will relieve you from all anxiety, and preserve the fertility of your soil and the strength of your population from impoverishment or decay.

We can only say that the theory is far too agreeable to be scouted. We should like nothing better than to see town and country come fairly to terms on the question. If our Drainage Commissioners could but discover that, instead of a substance worse than useless, they were disposing of a substance readily marketable, London might be relieved of its sewage-rates as well as its sewage. At present it is all outlay and no return, the only profit being in the good riddance of the refuse; but if these "avails," as Baron Liebig calls them, could be brought into demand, the whole process would be self-supporting, and the main drainage might be paid for by the value of its own produce. Can not this be managed? Must we still let all run to waste, when wealth as well as health might be realised by the same machinery? Our sanitary authorities talk to us, and we have listened to them with great advantage. Now Baron Liebig and Alderman Mechi and others are addressing us just as forcibly, and demanding attention in their turn. We think they ought to receive it.

The above facts most clearly show how every interest is bound up in that all important question "MANURE FOR THE SOIL."

The sewage of London is not much if we look round at the millions of hungry acres requiring its aid; even taking it at 500,000,000 tons per annum, it is not much under the strong thumb of his majesty the steam-engine in its present high state of perfection. If the work is one of a gigantic nature, the results will be gigantic in the fields in the shape of grain and supplies for our exhausted markets. Instead of its being a "*death in the pot*" in our rivers, it will be life in the pastures and a rich abundance, while our capitalists will find this a remunerative investment for their capital and to their country. It will instil new life into our already depressed iron and other trades, and give employment to thousands. As to the demand for the sewage, the farmer will require it for his corn fallows, to irrigate

his meadows for early pasturage, and for hay crops (*see letters from Malvern*); for giving his turnips and other seeds a good soaking as soon as they are committed to the soil; then again for a second irrigation as soon as his hay and clovers are carried, when new crops would spring forth as if by magic. During the severe droughts our climate is subject to, it will preserve the crops from harm; in fact, it will be required all the year round and almost every day. The plan for doing this has been approved by the highest agricultural authorities. We all know the present position of England is one full of extreme peril. But when once the sewage is judiciously applied, the agriculture and the commerce of England will be built on the immutable rock of nature's laws. Then the rains may descend, the floods sweep through the land, and storms rage. England's position will rest on a basis which shall not be shaken, and her sons be fed from her own healthy soil; but if neglected, the present *unsound fabric will fall, and great will be the fall thereof.*

THE END.

LONDON

PRINTED BY SPOTTISWOODE AND CO.

NEW-STREET SQUARE

METEOROLOGICAL TABLE OF THE CLIMATE OF ENGLAND, from the Year 1800 to 1861.

COMPILED FROM VARIOUS SOURCES. A VERY CORRECT ACCOUNT OF THE SEASONS FROM 1800 WILL BE FOUND IN LUKE HOWARD'S BAROMETROGRAPHIA AND METEOROLOGICAL PAPERS, AND IN THE PHILOSOPHICAL TRANSACTIONS.

TABLE I.

Series.	Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
I	1800	Sp.	♋	☊	...	Cold and late Spring
		Su.	...	...	...	Very wet and cold Summer
		Au.	...	...	...	Wet Autumn, deficient harvest
		W.	...	...	...	Changeable Oct. and Nov., snow in December
II	1801	Sp.	☊	...	...	**Cold in Jan., late Spring, snow 12 April**
		Su.	...	...	...	Fine Summer
		Au.	...	...	...	Fine Autumn, bountiful harvest
		W.	...	...	...	Fine October, snow in November, wet Decemher
III	1802	Sp.	♐	♓	☋ ☌ ♄	**Cold Spring, snow on May 16**
		Su.	...	...	...	Cold June and July
		Au.	...	...	...	Very hot Autumn, average crops
		W.	...	...	...	Cold changeable Winter
IV	1803	Sp.	...	...	...	**Cold Jan., Feb. and March, rather late Spring**
		Su.	♎	...	...	Very hot and dry Summer
		Au.	...	...	...	Fine Autumn for harvest
		W.	...	...	...	Mild October, wet November, cold windy Dec.
V	1804	Sp.	...	...	...	**Cold with snow, January, February and March**
		Su.	♍	♑	...	Fine Summer, warm at times
		Au.	...	...	...	Fine Autumn, good crops
		W.	...	..	...	Mild October, snow in December
VI	1805	Sp.	...	...	...	**Cold Spring, snow to April 29**
		Su.	♐	...	...	Cold summer with wet
		Au.	...	...	...	Wet and late harvest, deficient crops
		W.	...	...	...	Mild Winter to December
VII	1806	Sp.	...	...	...	**Cold, late Spring, snow in April**
		Su.	...	...	...	Fine hot Summer, with storms
		Au.	♑	...	...	Fine Autumn, good crops
		W.	...	♍	...	Mild changeable Winter
VIII	1807	Sp.	...	...	...	**Cold, late Spring, snow to 17 April**
		Su.	♒	...	...	Very fine hot Summer
		Au.	...	...	...	Fine Autumn, abundant crops, **large Comet**
		W.	...	...	...	Snow in November and Decemher, with cold
IX	1808	Sp.	...	...	...	**Cold, late Spring**
		Su.	♓	...	...	Excessively hot in May and July*
		Au.	...	...	...	Fine Autumn, good crops
		W.	...	...	...	Very cold in December
X	1809	Sp.	...	...	...	**Cold, deep snow 21 April**
		Su.	♈	♐	...	Wet and changeable Summer
		Au.	...	...	...	Rather fine, deficient harvest
		W.	...	...	...	Mild wet Winter
XI	1810	Sp.	♑	...	...	Early Spring
		Su.	...	♉	...	Hot Summer with thunder storms
		Au.	...	...	...	Very hot Autumn, good crops
		W.	...	♊	...	Hot in October, flooding rains in Nov. and Dec.
XII	1811	Sp.	♊	...	...	**Cold Jan., wet Feb. and March, early Spring**
		Su.	...	...	...	Warm and fine Summer and Autumn
		Au.	...	...	...	Bountiful crops, **GREAT COMET**
		W.	...	...	...	**Very cold in December**

* Men and cattle died from sunstrokes.

Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
1812	Sp.	♉	♈	...	Very cold and late Spring
	Su.	...	...	...	Treacherous Summer
	Au.	...	...	...	Very cold, bad harvest
	W.	♑	...	...	**Very cold Winter**
1813	Sp.	♑	...	...	Mild early Spring
	Su.	...	...	...	Fine warm Summer
	Au.	...	...	...	Fine Autumn, an abundant harvest
	W.	♍	...	...	Changeable Winter with rain and fog
1814	Sp.	♍	...	...	Very warm April, cold May and June
	Su.	...	...	...	Very hot July, average harvest
	W.	...	♒	...	Mild and stormy in December
1815	Sp.	♎	...	...	Warm early Spring
	Su.	...	...	...	Remarkably fine weather to October
	Au.	...	...	...	Fine and bountiful Autumn **OLBERS' COMET**
	W.	...	...	...	Severe and cold Winter
1816	Sp.	♍	...	...	**Very late and cold Spring**
	Su.	♍	...	...	Wet and cold Summer
	Au.	...	...	...	Disastrous Autumn, dreadful harvest
	W.	...	...	...	Changeable, with snow in November and December
1817	Sp.	...	...	...	**Changeable, snow in Jan. and Feb., a late Spring**
	Su.	...	...	...	Great heat in June, changeable July
	Au.	♐	...	...	And August, "good crops"
	W.	..	...	...	Rather mild October and November, cold in Dec.
1818	Sp.	♑	...	...	**Heavy rains in March and April**
	Su.	...	...	...	Severe drought all Summer, **Very hot**
	Au.	♑	...	...	Fine Autumn, good average crops
	W.	...	...	...	Very warm October and November, a mild Winter
1819	Sp.	♒	...	...	Early Spring
	Su.	...	♒	...	Dry and hot Summer from July to September
	Au.	...	...	...	Fine abundant crops, **LARGE COMET**
	W.	...	...	...	Severe frosts in November and December
1820	Sp.	...	♈	...	**Frost, and great snow storms to March 15**
	Su.	♓	...	...	Very hot Summer with frequent storms
	Au.	...	...	...	Fine, and abundant harvest
	W.	...	...	...	Mild and changeable Winter
1821	Sp.	♈	...	...	**Cold Spring, warm April, cold**
	Su.	...	...	☋ ☌ ♄	May and June, and July and August fine .
	Au.	...	...	...	Wet Autumn, deficient crops and damaged
	W.	♉	♑	...	Mild, and wet December
1822	Sp.	♉	...	...	Very early Spring
	Su.	...	...	...	Very hot Summer
	Au.	...	...	...	Fine Autumn, bountiful harvest
	W.	♊	...	...	Mild October and November, cold in December
1823	Sp.	...	...	...	**Cold and changeable Spring**
	Su.	...	...	...	Rather cold Summer, **A REMARKABLE COMET†**
	Au.	...	...	...	Very late Autumn, medium crops
	W.	♋	...	...	**Wet and cold Winter**

* The Thames frozen over.
† Singular Comet, with a tail extending toward the Sun.

Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
1824	Sp.	♋	♉	...	Very cold and late Spring
	Su.	...	...	...	Wet and cold Summer
	Au.	...	♊	...	Wet Autumn, deficient harvest
	W.	♑	...	...	November and December wet, but rather mild
1825	Sp.	...	...	...	Fine early Spring
	Su.	...	...	...	Very hot Summer, excessively hot at times*
	Au.	...	...	...	Fine Autumn, fair harvest crops **Great Comet**
	W.	♍	...	...	Rather mild Winter, with cold at times
1826	Sp.	...	...	...	**Cold with snow in January, afterwards mild**
	Su.	...	...	...	Very hot and dry Summer, abundant crops
	Au.	...	...	...	Fine harvest, and bountiful produce
	W.	♑	♐	...	Rather cold in November, mild December
1827	Sp.	♎	...	...	**Severe frost and snow till Feb., early Spring**
	Su.	...	...	...	Fine Summer, great heat at times
	Au.	...	...	...	Fine Autumn, good crops
	W.	♍	...	...	Mild Winter generally, with wet
1828	Sp.	♍	...	...	Early Spring
	Su.	...	...	...	Warm Summer, but wet July and August
	Au.	...	...	...	Wet Autumn, deficient harvest
	W.	...	...	...	Rather mild Winter
1829	Sp.	♐	♌	...	**Cold Spring and till end of April**
	Su.	...	...	...	Warm May and part of June
	Au.	♑	...	...	Wet Autumn, bad harvest, much grain spoiled
	W.	...	...	...	Severe Winter, great snow storms and frost
1830	Sp.	♑	...	...	**Severe, with much snow till February 8**
	Su.	...	...	...	Warm early Spring, wet June, hot July
	Au.	...	...	...	Changeable Autumn, fine crops, **Two Comets**
	W.	...	...	...	Severe frost and snow in December
1831	Sp.	♒	...	...	Changeable, and stormy Spring
	Su.	...	♍	...	Fine hot Summer
	Au.	...	...	...	Fine harvest
	W.	...	...	...	Mild but changeable Winter
1832	Sp.	♈	...	...	**Cold but not very late Spring**
	Su.	...	...	...	Fine Summer, **Three Comets**
	Au.	♈	...	...	A bountiful harvest, fine Autumn
	W.	...	...	...	Hot to the end of September, then changeable
1833	Sp.	♈	...	...	**Very wet Spring, with great floods**
	Su.	...	...	...	Very hot May, and to June 11
	Au.	♉	...	...	Wet and changeable Autumn, medium crops
	W.	♉	♑	...	Mild Winter
1834	Sp.	...	...	...	Early Spring, fine Summer
	Su.	...	...	...	Fine Autumn, bountiful harvest
	Au.	...	...	...	Excessively hot at times
	W.	♊	...	...	Rather mild Winter
1835	Sp.	...	...	...	**Cold, wet and changeable Spring**
	Su.	...	...	...	Hot and dry Summer
	Au.	...	...	...	Fine Autumn, bountiful crops
	W.	♋	...	...	**Wet and cold in December, HALLEY'S COMET**

* Men and cattle died from sunstrokes.

Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
1836	Sp.	♋	♑	...	Very wet and cold to end of April
	Su.	...	♍	...	Rather fine Summer But a
	Au.	...	...	...	Wet and cold Autumn, deficient harvest
	W.	♑	...	...	Much snow in October and Christmas day
1837	Sp.	♑	...	...	**Very cold, and the latest Spring for many years**
	Su.	...	...	...	Fine warm Summer, an abundance of fruit
	Au.	...	...	...	Fine Autumn, an abundant harvest, rather late
	W.	♍	...	...	Rather cold Winter
1838	Sp.	...	...	...	**Severe frost and snow to 24 Feb., a cold Spring**
	Su.	...	...	...	Very cool Summer
	Au.	...	...	...	Fine for harvest, average crops
	W.	♑	♐	...	Mild Winter except at intervals
1839	Sp.	...	...	...	**Very cold Spring, severe frost in March**
	Su.	...	...	...	Heavy thunderstorms and much rain
	Au.	...	...	...	Hot at intervals, medium harvest
	W.	♍	♉	...	Close and very wet Winter
1840	Sp.	...	...	...	Fine early Spring, warm and dry
	Su	...	...	...	Very hot in April and August, **3 small Comets**
	Au.	...	...	...	Fine Autumn, bountiful harvest
	W.	...	...	...	Severe winter weather in December
1841	Sp.	♐	...	...	**Severe until February 11**
	Su.	...	...	☌ ♄	Very wet June, July, and till 14 August
	Au.	♑	...	...	Fine very hot September, medium crops
	W.	♑	...	...	Very wet from September 22 to November 1
1842	Sp.	♑	...	...	**Cold and snow in January**
	Su.	...	...	...	Dry April and May, fine hot Summer
	Au.	...	...	...	Fine Autumn, superior crops, **Two Comets**
	W.	...	...	...	Wet October and November, fine warm Decemher
1843	Sp.	♒	...	...	Mild and stormy January, variable Spring
	Su.	...	...	...	Variable Summer, hot at times
	Au.	...	...	...	Fine and hot Autumn, good crops
	W.	♈	...	...	Hot Sept., dry and mild Dec. **Large Comet**
1844	Sp.	...	...	...	**Severe drought from March to Midsummer**
	Su.	...	♒	...	Very hot April, June, and part of July
	Au.	♈	...	...	Fine Autumn, an abundant harvest
	W.	...	...	...	Mild for the season, severe frost in December
1845	Sp.	...	...	...	**Very severe frosts and snow till March 21***
	Su.	...	...	...	Wet cold May, hot June and to July 8
	Au.	♉	...	...	Wet and gloomy Autumn, late and deficient crops,
	W.	...	...	...	Very mild Winter [potato disease
1846	Sp.	...	...	...	Early Spring
	Su.	...	...	...	Exceedingly hot Summer,† **Eight Comets**
	Au.	♊	...	...	Fine hot Autumn, abundant crops
	W.	...	♈	...	Rather mild Winter
1847	Sp.	...	...	...	**Cold, winds until May**
	Su.	...	...	...	Very hot Summer at times
	Au.	♋	...	...	Fine Autumn, abundant harvest
	W.	...	...	...	**Cold Winter**

* Mass of ice in the Thames.
† Men and cattle died from sunstrokes.

Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
1848	Sp.	♋	♈	...	Very cold January, wet but warm next 3 months
	Su.	...	...	...	Hot and dry May
	Au.	...	...	...	A very wet harvest, deficient crops
	W.	..	♍	...	Flooding rains to end of October, fine December
1849	Sp.	♌	...	...	**Cold Spring, wet May**
	Su.	...	...	...	Fine warm Summer, with storms
	Au.	♍	♈	...	Fine Autumn, good harvest, **Two Comets**
	W.	...	...	...	Cold and wintery at Christmas
1850	Sp.	...	...	...	**Cold Jannary, mild February, cold March**
	Su.	...	...	...	Fine April and May, hot June
	Au.	♑	...	...	Fine Autumn, good harvest, **Three Comets**
	W.	...	...	...	Mild Winter and pleasant
1851	Sp.	...	...	...	Wet March, fine spring
	Su.	...	...	...	Hot Summer throughout, **Four Comets**
	Au.	...	...	...	Fine Autumn, good harvest
	W.	♍	♉	...	Cold with snow in November, mild December
1852	Sp.	...	...	...	Dry parching Spring
	Su.	...	...	...	Showery June, intensely hot July, with storms
	Au.	...	...	...	Very wet Autumn, harvest mildewed and damaged
	W.	♐	...	...	Mild and wet to December, thunderstorm in Dec.
1853	Sp.	...	...	...	**Cold Spring, severe frost and snow**
	Su.	...	...	...	April very wet, warm June
	Au.	...	...	...	Wet Autumn, deficient crops
	W.	♉	...	...	Wet Winter to October
1854	Sp.	...	♊	...	**Snow storm Jannary 4, early warm Spring**
	Su.	...	...	...	Fine Summer
	Au.	...	...	...	Fine warm Autumn, good harvest
	W.	♒	...	...	Rather mild Winter
1855	Sp.	...	...	...	**Severe frost and snow Jannary and February**
	Sn.	...	...	...	Very fine Summer
	Au.	...	...	...	Fine Autumn, bountiful harvest
	W.	♈	...	...	Severe cold in Decemher
1856	Sp.	..	...	...	**Cold Spring**
	Su.	♋	...	...	Fine Summer, hot in July
	Au.	♈	...	...	Fine Autumn, abundant harvest
	W.	...	...	...	Rather mild Winter
1857	Sp.	...	...	...	Fine and rather early Spring
	Su.	...	...	...	Very hot season from May
	Au.	♉	...	...	Fine Autumn, abundant crops
	W.	...	...	...	Remarkably mild Winter
1858	Sp.	...	...	...	Fine early Spring
	Su.	...	...	...	Excessively hot Summer,* **GREAT COMET**
	Au.	♊	♌	...	Fine Autumn, average crops
	W.	...	...	...	**Severe frosts in November**, mild Decemher
1859	Sp.	...	...	...	Warm and early Spring
	Su.	♋	...	...	Very hot Summer, with storms
	Au.	...	...	...	Fine Autumn, average crops
	W.	...	...	...	**Severe frost and snow in December**

* Men and cattle died from sunstrokes.

Cycle.	Seasons.	½ in	¼ in	Planetary Conjunction.	Meteorological Changes.
1860	Sp.	♋	☊	...	**Very wet cold spring**
	Su.	♌	...	...	Cold, gloomy and wet Summer
	Au.	...	...	...	Wet Autumn, deficient crops, latest season for 44 yrs.
	W.	..	♍	...	Wet and cold to middle of December
1861	Sp.	♌	...	...	**Cold, severe frost and snow to end of February**
	Su.	...	...	...	Fine April and fine growing Summer
	Au.	♍	...	☊ ☌ ♄	Fine Autumn, good crops
	W.	...	...	...	Mild to December

METEOROLOGICAL TABLE OF THE CLIMATE OF ENGLAND from the Year 1728 to 1799.

FROM 1728 TO 1770 COMPILED FROM MR. ALLNUTT'S WHEAT AVERAGES. THE SEASONS FROM 1771 TO 1799 ARE COMPILED FROM VARIOUS SOURCES BY J. GLAISHER, ESQ., F.R.S., ROYAL OBSERVATORY, GREENWICH, PHIL. TRANS. 1850. TABLE II.

Series.	Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
I	1728	Sp.	...	...	Cold, late Spring
		Su.	...	...	Cold, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
II	1729	Sp.	...	...	**Severe frost, Thames frozen**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
III	1730	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
IV	1731	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
V	1732	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, bountiful crops,
		W.	...	...	[wheat 23*s.* 8*d.* per quarter
VI	1733	Sp.	..	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, bountiful crops,
		W.	...	...	[wheat 25*s.* 2*d.* per quarter
VII	1734	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Wet Autumn, deficient crops
		W	...	...	
VIII	1735	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
IX	1736	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
X	1737	Sp.	...	...	
		Su.	...	...	Cold, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops
		W	...	...	
XI	1738	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
XII	1739	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1740	Sp.	...	...	Cold Spring
		Su.	...	...	Cold, wet Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Very cold Winter, **severe frosts**
	1741	Sp.	...	...	**Severe Winter, Thames frozen over**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1742	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**LARGE COMET**
	1743	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1744	Sp.	...	...	
		Su.	...	...	Beautiful Summer and Autumn,
		Au.	...	...	[wheat 22*s.* 1*d.* per quarter
		W.	...	...	**GREAT COMET**
	1745	Sp.	...	...	
		Su.	...	...	Cold, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1746	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1747	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Severe Winter and cold
	1748	Sp.	...	...	**Spring, the Thames frozen over**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1749	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1750	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1751	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1752	Sp.	...	...	Late, cold Spring
		Su.	...	...	Cool, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1753	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1754	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1755	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1756	Sp.	...	...	
		Su.	...	...	Cold, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1757	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1758	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1759	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**HALLEY'S COMET**
	1760	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1761	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Severe Winter
	1762	Sp.	...	...	Thames frozen over
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1763	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**Cold Winter**
	1764	Sp.	...	...	Cold, late Spring
		Su.	...	...	Mild, wet Summer
		Au.	...	...	Late, wet Autumn, deficient crops
		W.	...	...	
	1765	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1766	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**REMARKABLE COMET**
	1767	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	
	1768	Sp.	...	...	Cold, late Spring
		Su.	...	...	Wet and cold Summer
		Au.	...	...	Wet and late Autumn, deficient crops
		W.	...	...	
	1769	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**GREAT COMET IN AUGUST**
	1770	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	
	1771	Sp.	...	...	**Very cold, severe frosts and snow to 20 A prl**
		Su.	...	...	Late, cool Summer; fine Autumn
		Au.	...	...	Late harvest, from the late spring
		W.	...	...	Wet October; mild to end of year
	1772	Sp.	...	...	**Cold to middle of March; late Spring**
		Su.	...	...	Fine Summer
		Au.	...	...	Mild, changeable Autumn; average crops
		W.	...	...	Mild Winter to December
	1773	Sp.	...	...	Mild, changeable Spring
		Su.	...	...	Cold, wet Summer
		Au.	...	...	Wet Autumn, deficient crops, **Large Comet**
		W.	...	...	Cold in November and December
	1774	Sp.	...	...	**Severe frosts in January and February**
		Su.	...	...	Cool, changeable Summer
		Au.	...	...	Changeable Autumn, good crops
		W.	...	...	Cold in November and December
	1775	Sp.	...	...	Mild, early Spring
		Su.	...	...	Hot and dry Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	**Cold and changeable Winter**
	1776	Sp.	..	...	Severe frost and snow, late Spring
		Su.	...	...	Mild, wet Summer
		Au.	...	...	Wet and late Autumn, deficient crops
		W.	...	...	Wet and mild to end of year
	1777	Sp.	...	...	**Cold Jan. and Feb., mild March, early Spring**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Rather cold Winter
	1778	Sp.	...	...	Cold but not late Spring
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, bountiful crops
		W.	...	...	Changeable; a severe storm S.& S.W. 31 Dec. like 1703
	1779	Sp.	...	...	Mild Spring
		Su.	...	...	Fine Summer
		Au.	...	...	A bountiful Autumn, but **much sickness**
		W.	...	...	Mild Winter
	1780	Sp.	...	...	**Very severe frosts and snow to March**
		Su.	...	...	Fine Summer, **much sickness**
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Mild Winter
	1781	Sp.	...	...	Rather mild, early Spring
		Su.	...	...	Hot, fine Summer
		Au.	...	...	Fine Autumn, good crops, **Two Comets**
		W.	...	...	Changeable but mild Winter
	1782	Sp.	...	...	Mild January, cold and wet late Spring
		Su.	...	...	Wet April and May, fine June
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Cold and severe in November and December
	1783	Sp.	...	...	Mild, pleasant Spring
		Su.	...	...	Fine Summer and Autumn, but
		Au.	...	...	**A REMARKABLE HAZE OVER ALL EUROPE***
		W.	...	...	Very cold with snow in December
	1784	Sp.	...	...	**Severe frosts and snow to March, late Spring**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Severe frosts in December
	1785	Sp.	...	...	Cold to the middle of March, late Spring
		Su.	...	...	Cool, wet Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Snow at Christmas
	1786	Sp.	...	...	**Cold and rather late Spring**
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Wet, changeable Winter
	1787	Sp.	...	...	Cold and rather late Spring
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Cold Winter at end of the year
	1788	Sp.	...	...	Wet, cold, with severe frosts
		Su.	...	...	Cool, changeable Summer
		Au.	...	...	Wet Autumn, deficient crops, but an abundance of [fruit
		W.	...	...	Cold in December
	1789	Sp.	...	...	**Very cold, rivers frozen over in January**
		Su.	...	...	Cool, changeable Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Mild, wet Winter
	1790	Sp.	...	...	**Mild to April, then snow storms, late Spring**
		Su.	...	...	Cool, changeable Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Changeable Winter, stormy in December
	1791	Sp.	...	...	Mild Spring
		Su.	...	...	Cool Summer to June, afterwards very fine
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Cold and stormy in November and December
	1792	Sp.	...	...	**Cold, frost and snow to March**
		Su.	...	...	Cold and wet Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Wet Winter to end of Year, **Two Comets**
	1793	Sp.	...	...	Mild Feb. and March, cold afterwards, late Spring
		Su.	...	...	Cold, wet Summer
		Au.	...	...	Wet, cold Autumn, deficient crops
		W.	...	...	Wet Winter, altogether a bad year
	1794	Sp.	...	...	Mild, early Spring
		Su.	...	...	Fine Summer
		Au.	...	...	Changeable Autumn, medium crops
		W.	...	...	Changeable, with frost and snow in December
	1795	Sp.	...	...	**Severe snow and frost to March, Thames frozen**
		Su.	...	...	Cool, pleasant Summer
		Au.	...	...	Fine Autumn, average crops
		W.	...	...	Mild to December, severe storms, S. and S.W.
	1796	Sp.	...	...	Mild, early Spring
		Su.	...	...	Fine, cool Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Severe frost in December
	1797	Sp.	...	...	Changeable, mild Spring
		Su.	...	...	Fine Summer, with storms
		Au.	...	...	Fine Autumn, good crops; **a Medium Comet**
		W.	...	...	Mild, open Winter
	1798	Sp.	...	...	Mild Spring
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn
		W.	...	...	**Severe frost in December**
	1799	Sp.	...	...	Very cold and late Spring, Thames frozen over
		Su.	...	...	Cold, wet Summer
		Au.	...	...	Wet and late Autumn, deficient crops
		W.	...	...	Foggy, with frosts in December

* The sun looked red. Awful thunderstorms at times; also a great meteor at 10 P.M. August 18.

METEOROLOGICAL TABLE OF THE CLIMATE OF ENGLAND from the Year 1656 to 1727.

COMPILED CHIEFLY FROM THE WHEAT AVERAGES BY MR. ALLNUTT.

TABLE III.

Series.	Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
I	1656	Sp.	...	...	Late cold Spring
		Su.	...	...	Cold wet Summer
		Au.	...	...	Cold Autumn, deficient crops
		W.	...	...	Wheat 38*s.* 2*d.* per quarter
II	1657	Sp.	...	...	
		Su.	...	...	Cold Summer
		Au.	...	...	Indifferent crops
		W.	...	...	Wheat 57*s.* 9*d.* per quarter
III	1658	Sp.	...	...	
		Su.	...	...	Changeable Summer
		Au.	...	...	Wet Autumn, indifferent crops
		W.	...	...	Wheat 50*s.* per quarter
IV	1659	Sp.	...	...	
		Su.	...	...	Average Summer
		Au.	...	...	Fine Autumn
		W.	...	...	Wheat 58*s.* 8*d.* per quarter
V	1660	Sp.	...	...	
		Su.	...	...	Cold wet Summer
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Wheat 50*s.* per quarter
VI	1661	Sp.	...	...	
		Su.	...	...	Cold Summer, **MEDIUM COMET**
		Au.	...	...	Wet Autumn, deficient crops
		W.	...	...	Bad year, wheat 65*s.* per quarter
VII	1662	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, price of wheat high
		W.	...	...	from preceding bad years, wheat
VIII	1663	Sp.	...	...	[65*s.* 9*d.* per quarter
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	..	...	Wheat 50*s.* 8*d.* per quarter
IX	1664	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Wheat 36*s.* per quarter
X	1665	Sp.	...	...	Cold late Spring
		Su.	...	...	Cold changeable Summer
		Au.	...	...	Wet Autumn, 68,000 died of the
		W	...	...	Plague of London
XI	1666	Sp.	...	...	[Wheat 43*s.* per quarter
		Su.	...	...	Fine Summer
		Au.	...	...	Fine Autumn, good crops
		W.	...	...	Wheat 32*s.* per quarter
XII	1667	Sp.	...	...	
		Su.	...	...	Fine Summer
		Au	...	...	Fine Autumn, good crops
		W.	...	...	

Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
1668	Sp.	...	...	Late cold Spring
	Su.	...	...	Cool Summer
	Au.	...	...	Rather wet Autumn, medium crops
	W.	...	...	Wet Winter, with cold
1669	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1670	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1671	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1672	Sp.	...	...	Late cold Spring
	Su.	...	...	Cold wet Summer
	Au.	...	...	Cold wet Autumn, deficient crops
	W.	...	...	Wet cold Winter
1673	Sp.	...	...	Cold Spring
	Su.	...	...	Very wet Summer
	Au.	...	...	Cold wet Autumn, very bad harvest
	W.	...	...	Wet cold Winter
1674	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1675	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1676	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1677	Sp.	...	...	Cold late Spring
	Su.	...	...	Wet and cold Summer and
	Au.	...	...	Autumn, very bad harvest
	W.	...	...	Mild wet Winter
1678	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1679	Sp.	...	...	Late cold Spring
	Su.	...	...	Wet Summer
	Au.	...	...	Cold Autumn, deficient crops
	W.	...	...	Cold Winter

Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
1680	Sp.	...	...	Late cold Spring
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	**GREAT COMET**
1681	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1682	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	**HALLEY'S COMET**
1683	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1684	Sp.	...	...	**Very cold Spring, Thames frozen**
	Su.	...	...	Cool Summer [in 11 in. thick
	Au.	...	...	Changeable Autumn, medium crops
	W.	...	...	Wet and cold Winter
16S5	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1686	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1687	Sp.	...	...	
	Sn.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	Wheat 22*s.* 4*d.* per quarter
1688	Sp.	...	...	Cold and late Spring
	Su.	...	...	Cool Summer
	Au.	...	...	Changeable Autumn, medium crops
	W.	...	...	
1689	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	**GREAT COMET**
1690	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumu
	Au.	...	...	Bountiful harvest
	W.	...	...	
1691	Sp.	...	...	Late Spring
	Sn.	...	...	Cold and wet Summer
	Au.	...	...	Cold wet Autumn, very bad harvest
	W.	...	...	Cold wet Winter, and

Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
1692	Sp.	...	...	Cold and late Spring
	Su.	...	...	Very wet Summer
	Au.	...	...	Cold wet Autumn, very deficient
	W.	...	...	Wet cold Winter [crops
1693	Sp.	...	...	Cold Spring
	Su.	...	...	Fine Summer
	Au.	...	...	Bountiful harvest
	W.	...	...	
1694	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1695	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1696	Sp.	...	...	Cold late Spring
	Su.	...	...	Cool Summer
	Au.	...	...	Wet Autumn, very bad harvest
	W.	...	...	Wet and cold Winter
1697	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1698	Sp.	...	...	Cold late Spring
	Su.	...	...	Very wet Summer Cold Autumn,
	Au.	...	...	earliest wheat not cut till Sept.
	W.	...	...	Scotch harvest cut at Christmas
1699	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1700	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	An.	...	...	Bountiful harvest
	W.	...	...	
1701	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	..	Bountiful harvest
	W.	...	...	
1702	Sp.	...	...	
	Su.	...	...	Fine year, with bountiful harvest
	Au.	...	...	**GREAT COMET**
	W.	...	...	
1703	Sp.	...	...	Late Spring
	Su.	...	...	A wet and cool Summer, and
	An.	...	...	Cold Autumn, deficient crops
	W.	...	...	Cold Winter, destructive gales

Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
1704	Sp.	...	...	Cold late Spring
	Su.	...	...	Cool Summer
	Au.	...	...	Wet and cold Autumn, medium
	W.	...	...	[crops
1705	Sp.	...	...	Cold Spring
	Su.	...	...	Fine Summer
	Au.	...	...	A severe drought all Summer
	W.	...	...	A bountiful harvest
1706	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	Wheat 23*s.* 1*d.* per quarter
1707	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1708	Sp.	...	...	Late cold Spring
	Su.	...	...	Wet and cold Summer
	Au.	...	...	Cold wet Autumn, deficient crops
	W.	...	...	Very cold Winter, **Thames frozen over**, wheat 36*s.* 10*d.* per qr.
1709	Sp.	...	...	**Late cold Spring**
	Su.	...	...	Cold Summer
	Au.	...	...	Wet cold Autumn, **deficient crops**
	W.	...	...	Very severe Winter, wheat 69*s.* 9*d.*
1710	Sp.	...	...	[per qrtr.
	Su.	...	...	Fine Summer and Autumn
	Au	...	...	Bountiful harvests
	W.	...	...	
1711	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvests
	W.	...	...	
1712	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1713	Sp.	...	...	Cold late Spring
	Su.	...	...	Cool changeable Summer
	An.	...	...	And Autumn, medium crops
	W.	...	...	Mild but wet Winter
1714	Sp.	...	...	
	Su.	...	...	Fine but very dry Summer, a
	Au.	...	...	remarkably dry year, fine Autumn,
	W.	...	...	good harvest
1715	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	Cold Winter

Cycle.	Seasons.	¼ in	½ in	Meteorological Changes.
1716	Sp.	...	...	Late cold Spring
	Su.	...	...	Wet Summer
	Au.	...	...	Cold wet Autumn, deficient crops
	W.	...	...	Severe Winter, Thames frozen 24 Nov.
1717	Sp.	...	...	**Cold and late Spring**
	Su.	...	...	Very hot Summer
	Au.	...	...	Fine Autumn, bountiful harvest
	W.	...	...	
1718	Sp.	...	...	
	Su.	...	...	Very hot dry Summer, scarcely any rain
	Au.	...	...	from 1 May to 5 Nov. bountiful harvest
	W.	...	...	
1719	Sp.	...	...	
	Su.	...	...	Very dry Summer and Autumn
	Au.	...	...	Bountiful harvest
	W	...	...	
1720	Sp.	...	...	Cold Spring
	Su.	...	...	Cool and changeable Summer and
	Au.	...	...	Autumn, medium crops
	W.	...	...	Cold wet Winter
1721	Sp.	...	...	Late Spring
	Su.	...	...	Cold changeable Summer and
	Au.	...	...	Autumn, medium crops
	W.	...	...	Cold and wet winter
1722	Sp.	...	...	
	Su.	...	...	Fine dry Summer and Autumn
	An.	...	...	Bountiful harvest
	W.	...	...	
1723	Sp.	...	...	
	Su.	...	...	Very hot and dry Summer
	Au.	...	...	Fine Autumn, bountiful harvests
	W.	...	...	
1724	Sp.	...	...	
	Su.	...	...	Very dry Summer
	Au.	...	...	Fine Autumn, bountiful harvest
	W.	...	...	
1725	Sp.	...	...	Cold late Spring
	Su.	...	...	Very wet Summer, great floods
	Au.	...	...	Wet Autumn, bad harvest
	W.	...	...	Mild wet Winter
1726	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	
1727	Sp.	...	...	
	Su.	...	...	Fine Summer and Autumn
	Au.	...	...	Bountiful harvest
	W.	...	...	Cold Winter